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THE

AGRICULTURAL LEDGER

1906—No. 3.

ACACIA CATECHU.

(CUTCH.)

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. I., A., 135-199.*]

Composition and Trade Forms of Indian Cutch, by DAVID HOOPER, F.C.S.

Other Agricultural Ledgers that may be consulted:

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ACACIA CATECHU

(CUTCH.)

[*Dictionary of Economic Products, Vol I*, A. 135 199.]

Composition and Trade Forms of Indian Cutch, by DAVID HOOPER, F C S

Introduction

INTRODUCTION

The present Agricultural Ledger is written with the object of bringing together information on the manufacture, trade forms and composition of Indian and Burmese cutch Reference is made to the distribution of the Acacia Catechu and the centres of the cutch markets, which hitherto have but been the subjects of scattered notes in periodicals Analytical tables are given of the composition of most of the available trade varieties of cutch and these will enable an estimate to be made of their comparative values For medicinal purposes it is important to know the amount of astringency, and the presence and nature of impurities to be met with in the Indian samples, in order to compare them with Gambier of the Straits Settlements which is appreciated as a substitute in this country and is being recognised in the Pharmacopœias of other nations The trade in cutch has been declining of late years, and it is hoped that the publication of these results will give an impetus to an important indigenous industry

TREES WHICH YIELD CUTCH

The cutch tree of India is known as the *Khair* and the extract is called *Kat, Kath* or *Katha* The Acacia Catechu, *Willd*, was regarded as a distinct species by Dr Roxburgh, and the allied species, A catechuoides and A. Sundra, were recognised as being used with the first in the preparation of the commercial extract. In 1897, however, Lieutenant Colonel D Prain, LL D, F R S, regarded these three trees as varieties of one species, and in a paper entitled "Some Additional Leguminosæ" (*Journal Asiatic Society of Bengal*, Vol LXVI, Pt II, pp 508 9) he established the characteristics and respective areas of distribution of the three forms of the plant.

CUTCH YIELDING TREES

Colonel Prain's conclusions may thus be summarised —

(*a*) A. Catechu, *Willd* (proper) This is the most Northern form having been recorded as met with in Hazára Kashmir, Simla, Kángra, Garhwál, Mussoorie, Central India, Bihár and south to Ganjam It has never been found in the Eastern Himalayas nor in Assam, and it has only once been reported as met with in Burma, *viz*, at Pegu, where according to Kurz it is called *sha* This is therefore the kath-yielding form of Kumaon or *papri khair* as it is sometimes called

(*b*) A. catechuoides *Benth*, is met with in Bengal from Monghyr and Patna to Sikkim, Assam and Burma. Though quite common in Pegu and Prome it has not as yet been collected in the Shan Hills nor in Upper Burma to the north of Ava This is therefore the cutch-yielding form of Burma; and Pegu or Rangoon cutch is the chief commercial form of the extract

(*c*) A Sundra, *DC.* Colonel Prain distinguishes this as the Southern and Western plant which affords the cutch of Madras and Bombay Presidencies It is very common from Coimbatore northwards to the Deccan, Kángra and the Konkan, and has been recorded as far towards the north-west at Kathiawar and in Rajputana, also to the north-east in Burma, at Segain, Mandalay and the Shan Hills It is the *lál khair* or Red Catechu

How far these varieties of the tree influence the composition of the extracts made from them will be noticed in discussing the chemical composition of trade samples Before dealing with that subject it will be convenient to refer to the districts in India where cutch is manufactured and to describe the peculiarities of manufacture that regulate the trade forms

WHERE MADE. Bengal.

Bengal.—One of the earlier writers on the industries of this province is Dr Buchanan-Hamilton whose diaries were edited by Montgomery Martin He described in 1838 the manufacture of *Khair* from Acacia Catechu in Dinajpur. The tree is common in the woods of Peruya, Jagadol and Ghoraghat; but it is only in the first that any of the drug is prepared The number of people employed in this manufacture is small Trees are selected that are at least two feet in circumference and these are old; for in this district the tree does not grow to a large size The bark and white wood are removed and then the heart-wood is cut into small pieces and beaten into a kind of stringy substance by means of an instrument called a *dhenki* Equal quantities of this and of water are put into earthen pots, each holding from 10 to 20 seers (20·5 lbs to 41 1 lbs) and are boiled for about six hours Each fire contains two or three pots The decoction is then decanted into a pot, and is formed into two kinds of catechu, *khair* and *papri khair*, the first dark and the second light coloured The first is made by simply allowing the extract to dry in the pot without addition, the second is made by putting some ashes of cow-dung

in the bottom of the cooler The ashes are covered with a fold of muslin, over which the warm extract is poured It is sold to the merchants in these pots and by them is formed into balls and dried in the sun The season for manufacturing cutch is from November to March, none can be made in these districts in the rainy season

CUTCH WHERE MADE

Maldah

A small quantity is made in Maldah, but the Maldah Khair is not reckoned of best quality, and the tree is rather scarce in the neighbourhood

Chutia Nagpur

The industry is more or less reserved in Palamau in Chutia Nagpur by an inferior caste called Mallahs, who extract *kath* from November to March They do not cut very small trees, which have little or no heart wood, and they never touch old trees Trees from 2' to 4' in girth are generally cut for the purpose The sapwood is removed and the heart wood is split up into thin chips with axes The chips are then boiled in earthen vessels for 10 or 12 hours and the solution obtained is poured in separate vessels and boiled over again, and this goes on till the liquor acquires the consistency of a thick syrup, which is then kept in big bamboo baskets lined outside with earth and cow dung After a few days, when the thick syrup becomes paste-like it is poured over *chaldis* (mats) strewn over with ashes, and made into any forms the manufacturers like The *kath* or cutch obtained by first boiling the chips is of best quality, and that obtained by second boiling is of second quality, and sometimes a third boiling is made when a third class extract results

In other parts of Chutia Nagpur *kath* is prepared and sold in the Manbhum and Jhalda pergannahs The annual production in Manbhum is estimated at 40 or 50 maunds (29 38 cwt. or 36 73 cwt), and the rate of sale is about four seers (8 22 lbs) a rupee (1*s* 4*d*) when dry In Jhalda the outturn is smaller, as the neighbouring jungles contain fewer trees

Dr McCann in his "Dyes and Tans of Bengal" (1883) reported that about 1 000 maunds (734 69 cwt) of catechu was annually consigned from Hazaribagh in Chutia Nagpur to Calcutta where it sold at from R8 to R12 (10*s* 8*d* to 16*s*) per maund (82$\frac{2}{7}$ lbs)

Patna is the emporium of Janakpuri cutch and of that made near Garhwa in Palamau Chetra in Hazaribagh, Ahraura in Mirzapur and Bas Bareilly, Pilibhit and Katni Marwar

Nepal

Tirhoot

Janakpuri cutch is prepared in Nepal and the Nepal Terai and is brought to Patna through the frontier stations of Tirhoot, Champaran and Bhagalpur It receives its name from the town of Janakpur (Pupri) in Muzaffarpur It is manufactured at Raksal and Katkanwa in Champaran Bairagania Birganj and Janakpur in Muzaffarpur, Bhimnahar and Bhaptiahi in Bhagalpur, and Madhuapur in Darbhanga

Janakpuri cutch.

Janakpuri cutch is made from the wood of the *khair* tree by boiling the chips in an iron pan and straining the liquor through cloth It is again boiled until it becomes thick, when the extract is

CUTCH WHERE MADE.

spread over a cloth or gunny placed on sand and dried in the shade It is supposed that drying in the sun has a deleterious effect and produces a black cutch of inferior quality The only restriction on the manufacture is the payment to the Forest Department of R4 (5*s* 4*d*) for each maund (= 82⅔ lbs) of extract prepared

The cutch obtained in the Patna market is of the Janakpuri variety and is divided into three classes according to its quality—

		Per maund. = 82⅔ lbs. R
1. Pakra or hatipawn	(29*s* 4*d*)	22
2 Kachru	(27*s* 8*d*)	20
3 Talia, pakri or kala	(21*s* 4*d*)	16

The first has an earthy pinkish fracture, and is full of catechin, the second is darker with a moderate amount of catechin, while the third quality is black in colour, having a brittle, shining fracture

Orissa

In 1893 the Secretary of the Bengal Chamber of Commerce wrote to the Reporter on Economic Products, suggesting an enquiry into the origin of the cutch made in Orissa and the Orissa Hill States Armenian and Jewish traders are aware that before Burma cutch took possession of the market, Orissa cutch was well known in Calcutta The Secretary of the Chamber had purchased cutch at Chandbali where it was called Black Heart." It was badly prepared and was sold in hard dark coloured cakes The enquiry was passed on to the Conservator of Forests, Bengal, and the following notes regarding the trade carried on in cutch in the Orissa Tributary States were supplied by the Officiating Superintendent, Cuttack

The article is not considered a very paying concern in the Tributary Mahals and the trade is confined only to the following six of the seventeen States —Athmallik, Bod, Daspalla, Mohurbhanj, Pal Lahers and Talcher

The Tributary Mahals forests do not abound in catechu plants, and where they do the manufacture of cutch is carried on to a very limited extent It is manufactured by a professional class of aborigines called *Khairas* or cutch manufacturers the tract of the jungle being first leased either by traders from the plains or the *Khairas* themselves The quantity manufactured finds ready sale in the Garjat local markets and in Cuttack

The quantity turned out is not large In Athmallik the Maharaja reports the value of the manufactured article to be not more than R1,000 (£66 13*s* 4*d*) during 1893 In Bod and Daspalla, the annual outturn is estimated to be 300 maunds (= 220 4 cwt) and 50 maunds (= 36 73 cwt.), respectively In Mohurbhanj Pal Lahers and Talcher the quantity manufactured is not more than sufficient for local consumption, though sometimes in the two latter the surplus is exported to Cuttack

In the Buxa Forest Division, the trees are of the ordinary kind that grow plentifully along old river beds and on waste land all over the country All trees yield more or less extract but there seems to be a great difference in the quantities obtained from the wood It appears that those most gnarled and creviced and generally badly used matured trees give the largest yield this opinion is supported by the fact that the crystalline catechin may be picked out of the cracks and cavities in the heart wood If a khair tree be cut down in the rains a crystalline substance oozes out from the centre of the stump as well as from the log A specimen of this was separated by boiling the chips cut as small as possible in a kerosine tin of water for half an hour, the decoction was then strained into shallow wooden boxes and set to cool In from two to four days the catechin crystallised out and adhered to the sides and bottom of the box. Most of the dark brown liquid was then poured off and the balance was stirred up and turned into a filter press and squeezed into a cake The cake was then dried in the sun, after which it had a brown appearance from a portion of the tannin drying on the surface This process aimed in getting catechin, and this could be obtained almost pure by washing with sufficient water

CUTCH WHERE MADE

Buxa in Northern Bengal.

Cutch may be made from the bark as well as from the heartwood of the tree, but in the former case the extract is very black and, as shown by analysis, contains no catechin

Assam

Assam —The khair tree is distributed in this province and is abundant in the districts of Goalpára Kamrup and Darrang, but no cutch has ever been made there on a large scale The product is almost unknown among native manufacturers and in a commercial sense is almost non existent

Central Provinces. Eastern parts

Central Provinces —Regarding the trade in cutch in certain feudatories attached to the Sambalpur district, the following information has been communicated

Sonpur is a Native State lying to the south of Sambalpur district and the Mahanadi traverses it from north west to south east, so that whatever cutch is produced there is carried away by river to Cuttack and does not pass through Sambalpur There is very little forest in the State, it is a plain country and has been to a great degree brought under cultivation and it is not probable that there can be any considerable trade in cutch in this State

Patna Native State lies to the south-west of Sonpur and only touches the Bargarh Tahsil of the district in the extreme south west It is reported that Patna is a well wooded State and it is probable that a fair amount of cutch is produced there Everything not needed for home consumption is exported to Sonpur and thence down the Mahanadi to Cuttack The production of cutch in Patna State is about equal to the production in Bamra

Bamra State lies to the east of this district It is covered with dense forest and yields a good supply of cutch In Bamra the

CUTCH WHERE MADE
Central Provinces Eastern parts.

Feudatory Chief is the principal merchant and nearly all the cutch produced in the State is carried to his depôts and delivered to his agents at a fixed rate The Chief's agents sell it to traders who carry it away by rail or river The Feudatory Chief of Bamra has kindly furnished the following information regarding this subject —

Cutch is produced in the Atpara, Naikool and Gourpali parganas of the Bamra State The annual production does not exceed 250 maunds No merchant purchases directly from the producers All the cutch produced is purchased by the Chief at from 4 to 5 rupees (*5s 4d* to *6s 8d*) per maund (=82⅖ lbs) and is sold again at his depôts to merchants at from 7 to 8 rupees (*9s 4d* to *10s 8d*) per maund It is also probable that a small quantity is smuggled out of the State by traders without passing through the Chief s depôts

Radakole is a State with more jungle than cultivation and the production of cutch there must be equal to the production in Bamra State Some of the cutch produced in the western part of the State is carried by men or on pack bullocks to Sambalpur for sale, but the major portion goes down to the river to Cuttack or by road through Angul to Cuttack.

All the cutch exported from the feudatories of this district is usually in the form of soft cutch

The Conservator of Forests reports that in Sambalpur earthen pots are used for boiling down the liquor. The thick liquid, when sufficiently concentrated, is poured into small cups made of palmyra or other leaves and exposed to the sun for 10 to 15 days, when the cutch becomes hard and dry It is sold locally at 4 annas (*4d*) per lb or R10 (*13s 4d*) per maund (82⅖ lbs)

Central Provinces, Central parts

The Deputy Conservator of Forests, Seoni describes the process of making the square-shaped cutch at Korai When the extract is of the consistence of a thick paste it is poured into moulds made of fine sand The sand absorbs what little moisture is still left in the paste and the Katha remains. This is cut into small blocks about two inches square by half an inch in thickness These are sold by contractors in the Kampti market

Central Provinces Northern parts

In Damoh, another district in the Central Provinces, the cutch boiling industry has been carried on for many years by professional *Khairuas*. The quantity of *Katha* manufactured in 1903-04 was about 400 maunds (=293 87 cwt), the market value of which at R11 (*14s 8d*) per maund (82⅖ lbs) was R4,400 (£293 *6s 8d*.)

United Provinces

United Provinces.—Major Madden during his tour in 1847 through "The Turaee and other mountains of Kumaun" (*Journal Asiatic Society, Bengal, XVII, 565*) describes the manufacture of kath or catechu by a class of Doms called *Khairias*, after the name of the tree Trees with an abundance of red heart wood are most esteemed, and these are reduced to thin slices and boiled in Kedgree pots Madden speaks of the kath in the concentrated liquor crystallising on leaves and twigs thrown into the pots for this

purpose Later observers state that twigs are not now used to assist crystallisation and that the evaporating liquor is stirred with sticks dipped in castor oil to prevent frothing There is a fair local demand for Kumaun kath but the manufacture and trade are in the hands of poor unenterprising people and there does not seem to be any promise of much expansion Another evil threatening the once flourishing industry is the gradual extermination of the Khair tree by annual savannah fires, and Government propose to remedy this by reserving 12 000 to 15 000 acres of khair forest and arranging for their protection against fire and grazing

CUTCH WHERE MADE

Bombay Presidency, North Kanara

Bombay—Dr Buchanan Hamilton describes the making of *cut* or catechu near Ankola in North Kanara during his tour in 1801 The trees grew spontaneously on the hills of the Konkan and were observed nowhere else in the peninsula The extract was made by boiling the chips of the heart wood in the usual way, and when it was sufficiently hard it was poured on to the ground covered with rice husks and made into balls about the size of oranges and dried in the sun seven days These were sold to merchants residing at Dharwar and Stanore who supplied the greater part of the peninsula with this article which among the natives was in universal use The greatest supply came from that part of the Konkan which was subject to the Marathas and was considered of very good quality

Possibilities of Nasik

In a recent Forest Report it is said that in the Nasik division of Bombay, Khair trees will never yield valuable timber and the extraction of catechu in these forests would produce a revenue which could not otherwise be tapped

Gujarat

People employed in Gujarat in the manufacture of kath or catechu are called Kathodias an aboriginal tribe much resembling Bheels The men bring in the khair wood from the jungle and cut it into chips, the women boil the chips and extract the kath

The tree best suited for the purpose is one of from 25 to 30 years of age and the more thin white lines visible in the heart wood the greater is the quantity of kath it contains The Kathodia tests whether the tree will pay to fell by cutting a small notch into the heart wood

After the tree is cut the Kathodia removes all the sap-wood, and a little of the heart wood with it from the bole, and takes it home to cut into chips which he does with a small axe of a peculiar shape The chips are about the thickness of wood used for match boxes and about a square inch in surface

The chips are boiled in small earthen pots with rather more than two quarts of water, the chips are renewed three or four times a day three or four handfuls being put in each time The water is poured off from time to time when considered sufficiently impregnated with kath into two pots kept on purpose and allowed to go on boiling, fresh water is put into the pots from which the liquid has been poured off

CUTCH WHERE MADE

Gujarat

At the end of the day the infusion in the two pots is poured into a wooden trough, about a yard long and eighteen inches broad, and goes through a peculiar process of straining A woman takes a piece of blanket about a foot square, dips it into the infusion, stirs it about and then wrings it out again into the trough holding it as high up as she can from a sitting position This process goes on for about two hours, after which the trough is covered up with a lid made of split-bamboos, and the infusion allowed to throw down a sediment which is kath, all the water is poured off and the kath is made into small pats and allowed to dry

Kath ready made, is sometimes found in the centre of some trees This kind of kath is the most valuable, and is called Khersal

The Kathodias are employed in large gangs from 50 to 75 families (each family represents a kath furnace) by contractors who obtain permits from the Forest Department for the manufacture of kath and make their encampment near a river in the jungle so as to have a large supply of water at hand, a kath furnace has from eight to twelve pots placed in a double row The two central ones are used to receive the liquid from the other pots

Kath manufacture is very destructive and should never be permitted in jungles where the khair grows straight or is accessible If allowed only such trees should be marked as are not fit for timber, by reason of their crookedness or other defect In the Bombay Forests, where manufacture of kath is allowed none but crooked trees unfitted for timber uses are felled and every tree is previously marked for the axe by an officer of the Forest Department [*J Macrae, Indian Forester*, Volume I, (1875) 282]

Madras, South Kanara.

Madras.—In this Presidency cutch is most extensively manufactured in the Kanara district The method of preparation in South Kanara is given in the District Manual, from which the following extract is taken —

"The catechu trees are felled, and their branches and sap wood re [illegible]

from the chips, the decoction is strained into a trough placed at the foot of the still and immediately transferred to another vessel of which about half a dozen are placed on the ovens in a line The chips once boiled are again mixed with the same quantity of water and again boiled The process of boiling and straining is repeated six times and at every time the decoction obtained is strained and transferred to the pot containing the former decoction The decoction is itself boiled again for about six or seven hours until it attains a dark brown colour and becomes gummy It is then discharged into an open, shallow vessel and stirred by a ladle until it becomes semi solid by oxidation, which it does in about five or six hours It is made into balls, each of 1½ inches in diameter, and the balls are rolled in ashes The above preparation is said to produce 45 balls weighing 10½ lbs Here ends the work of the people—males

and females of the Kudubi caste—engaged for the purpose. After receiving the balls from the Kudubis the contractor has to go through a further process of rubbing them five or six times for two or three days, heaping them upon an air tight covering of ashes, in which state they are kept for three or four days and then giving them another rubbing, after which they are spread out in the shade to dry, when dried the above 45 balls weigh about 9 lbs. The balls thus prepared are delivered over by the contractor to the Forest Department, which pays him the price agreed upon, viz., R60 (£4) per candy of about 3,000 balls.

CUTCH WHERE MADE

South Kanara

"The manufacture of catechu is carried on from about the end of December to the middle of March. It is confined to a jungle tribe, called *Kudubis*, who speak a dialect of Konkani and are said to have migrated into the district from Goa when it came under the sway of the Portuguese in the sixteenth century. When the Kudubi is engaged in the manufacture of catechu, he makes the site of the boilers his home, the Kudubi woman being as much essential to the work as the Kudubi man. The work of the male ends when he has felled the trees and cut the heart wood into chips, all the rest of the process until the catechu balls are delivered to the contractor falling to the share of the female. The Kudubi gets from R1 to R1 4 (1s to 1s 4d) for every 100 balls manufactured or R40 to R50 (£2 13s 4d to £3 6s 8d) for every 4,000, balls which is generally the unit of account between the contractor and the Kudubi. During the three years ending with the 31st March 1894, about 4? tons of catechu were manufactured at a cost of R11,630 (£775 6s 8d) and the sale of these realised R25,857 (£1,723 16s), leaving a total profit of R14,227 (£748 9s 4d) or R4,742 (£316 2s 8d) per annum to the Forest Department. The manufacture of catechu gives employment to nearly fifty or sixty families of Kudubis and the average monthly income of a family amounts to about R8 (10s 8d).

"The catechu manufactured in South Kanara appears to command a higher price than the product of Mysore on account of the careful and neat method employed by the Forest Department in its preparation; the former fetches R135 (£9) per candy, while the latter scarcely realizes more than R100 (£6 13s 4d). The catechu manufactured in South Kanara is chiefly sold in Mysore where it is eaten with *pan* (betel leaf) and administered as a medicine to women immediately after confinement."

In 1903 04, 1,561 maunds (Madras maund = 25 lbs) or 18 8 tons of catechu were made in South Kanara and sold for R13,953 (£930 4s). The departmental cost of the extract was R172 (£11 9s 4d) per ton and it realised R801 (£53 8s) per ton. A few tons were sold to the Harness and Saddlery Factory at Cawnpore, and the Mysore State took the remainder for consumption. In 1904-05, 1,466 maunds (16 tons) were made and sold for R11,431 (£762 1s 4d). The cost price being R160 (£10 13s 4d) per ton and the selling price R700 (£46 13s 4d). An interesting account of catechu and catechu boiling in South Canara, written by Mr H. A. Latham, appeared in the *Indian Forester*, May 1906.

Market of cutch from South Kanara

Burma.—In Lower Burma the manufacture of cutch is carried on in much the same way as in other parts of India. If trees are plentiful the manufacturer makes an incision into the heart-wood before felling, to determine whether or no the wood is s—

Burma.

CUTCH WHERE MADE.

Burma method of manufacture.

whether it contains *ngyi* (the Burma name for kersal). The presence of such spots indicates catechin and assures the outturn of a hard cutch which is of greater value than soft. The presence of *ngyi* is therefore of primary importance and trees without spots are rejected if there is a sufficiency of trees with them. According to Mr. H. Slave ("Cutch Manufacture in Burma," *Indian Forester*, 1892) cutch boilers recognise four varieties of Acacia Catechu distinguished by their bark and the colour of the heart-wood. These are Sha-ni or red cutch, Shaw-wa or yellow cutch, Sha-bya Kyaung-mwe or blue cutch, and Sha-net or black cutch. Of these four varieties red cutch is considered the best, the cutch manufactured from the blue cutch will never set by itself, so it is always mixed with the extract from one of the other varieties.

The selected trees are deprived of their bark and sap wood and the logs are cut up into convenient lengths of about 7 feet. These logs are converted into chips about an inch square and a quarter of an inch in thickness. The boiling of the chips with water is conducted in several earthenware pots each containing about three gallons, and the extract is transferred to a large iron pan of the capacity of twelve gallons. The liquid is boiled down until it attains, with constant stirring, a viscous consistence. The cauldron is then taken off the fire and to prevent the extract from solidifying at the top before it does so at the bottom, it is constantly stirred with a flat piece of wood shaped like a paddle until it is cold enough to be handled. It is then poured into a brick shaped mould, generally lined with leaves, and left to cool. The result is a mass of dark cutch varying in consistence according to the quantity of kersal contained in the wood used.

In Upper Burma the process of manufacture is generally the same as in the Lower Province. In 1890-91 cutch was being manufactured in the following seven forest divisions, that giving the largest outturn being placed first:—Mabu, Pyinmana, Yaw, Mu, Mandalay, Katha and Chindwin. In the Yaw Forest of the Mu division a somewhat different form of cutch is made other than that of the conventional article. The cutch is boiled in the ordinary manner, and is then thrown into a bamboo basket to see whether it will set. When it becomes hard it is put back into the cauldron and re-melted. A good quantity of *than* (Terminalia Oliveri) bark is added to give it a good colour and harden it. It is then thrown into small conical moulds made by pressing a blunt-pointed stick into the ground and lining the holes thus made with leaves of Cassia Fistula or a species of Bauhinia. When the cutch has solidified the leaf moulds are stripped off the cakes.

Markets of Burmese cutch.

This cutch is made specially for the Shan market and is only used for chewing. It is sold at Bhamo at R24 to R30 per cwt. The quantity produced is comparatively small.

Burmese cutch is often sold in the shape of small blocks. This

is accomplished by using a mould with the dimensions of 3'×8"×1," and before the cutch is thoroughly set it is cut into strips about 3 or 4 inches wide the cutch then assumes the form of slabs found in the market, the dimensions of which are 3"×8"×1"

CUTCH WHERE MADE

Minbu

From the Sinbyugyun forests of the Minbu division of Upper Burma varieties of cutch are known as black, yellow and red The colours are said to be much more apparent where the cutch is fresh from the boilery A forest official states that they are all manufactured by the ordinary Burmese process the only difference being in the shape of the mould employed The yellow cutch of Pegu occurs in roundish cakes about two inches in diameter and half an inch in thickness The colour externally is yellowish brown and internally reddish brown There is nothing in the analysis to account for the colour

Prome

In the Padaung township of the Prome district a few boilers adopt a somewhat different process and form the product into balls Only earthenware pans are used for boiling and evaporating the liquor The thick extract is poured into a wooden trough and agitated by a long stirrer until it commences to solidify It is then rolled into balls about the size of marbles The balls are dried on palm leaves near a fire As soon as they begin to swell slightly they are removed and are ready for market where they sell for R30 (£2) per cwt

Experiments in India

MANUFACTURE IMPROVEMENT OF

Recognition of good wood.

Experiments have been made in India to elucidate some of the obscure points connected with the native methods of manufacturing cutch Dr Warth in 1890 tested the quality of the wood of the Catechu tree by taking several samples showing a large and small proportion of spots in the heart wood to verify the statement of Kath makers that the white spotted wood yielded a superior extract than that made from black heart wood The result of the experiments showed that spotted wood gave more extract as well as more catechin Authenthic specimens were collected in Oudh and Burma and were of the following description —

Oudh No 1 —Reported unfit for making *Kattah* 1 in 1,000 of white pores

Oudh No 2 —Reported good for *Kattah* 1 in 6 of pores

Burma A —No white spots, but *khersal* present

Burma B —Exhibiting white spots, 1 in 20

Burma C —White spots 1 in 3

	Maximum per cent ext act.	Mean per cent Catech n	Catech n pe cent in wood.
1	14	36	5
2	24	40	9
3	17	14	2
4	16	31	5
5	20	28	6

CUTCH MANUFACTURE, IMPROVEMENT OF

As might be expected these results show that deposits of catechin exhibited in the wood contribute to form an extract of good quality, on the other hand, there is evidence of good cutch being manufactured from wood reported by professional boilers to be unfit for use

Cutting up wood

Dr Leather next dealt with the best methods of cutting up the timber, with the effect of different kinds of water, the quantity of water required and the time which was essential to boil the wood

1 With regard to the form in which the wood should be used Experimenting with wood in the form of chips, sawdust and shavings *and treating them with boiling water under similar conditions, it* was shown that the chips yielded 3 8 per cent of extract the sawdust 12 per cent and the shavings 15 1 per cent The conclusion is thus easily drawn that the finer the state of division of the wood the greater quantity of extract is obtained

Amount of water for boiling

2 The second point was the amount of water to be used in extracting the wood Experiments in this direction proved that ten parts or less of water to one of wood was ample for exhausting the soluble contents In this connection it was shown to be immaterial to the process whether the water used was hard or soft

Time required for extraction

3 The time required for extraction The native cutch-makers boil the wood for several hours, but it appears that half an hour is quite sufficient to exhaust the wood The prolonged boiling is conducted by the cutch maker as the second part of the process, *viz*, the concentration of the extract

The Yield.

Yield

The amount of extract obtained from the heart-wood of the khair tree varies considerably in individual samples Dr Warth obtained 6 to 14 per cent in unspotted heart wood and 4 to 24 per cent in spotted heart wood from the United Provinces, and in samples from Burma 12 to 17 per cent in unspotted wood and 14 to 20 per cent in spotted wood In Pegu, where the manufacture is on a large scale, it is calculated that 250 to 300 pounds of cutch is yielded by 1 ton of wood This is equivalent to 11 1 to 13 3 per cent A sample of the chips used in the Burma factory was estimated by me in 1900 and was found to contain 14 3 per cent of total dry extract a very fair proportion of the soluble contents is therefore extracted by the factory process

In the South Canara District, Madras, the yield of extract from heart-wood chips is about 11 per cent.

Trade Forms of Cutch.

TRADE FORMS

Pegu cutch.

Pegu Cutch.—This form enters Commerce through Rangoon or Calcutta. It occurs in large solid masses, sometimes weighing one hundredweight, or is made up of flat quadrangular cakes about 6 inches long and 1 inch in thickness Both forms are usually wrapped in leaves or have leaf impressions on the outside The leaves employed for this purpose are those of Dipterocarpus tuberculatus, Stephegyne diversifolia and the scabrid leaves of

CUTCH TRADE-FORMS.

Tectona hamiltoniana This cutch is dark reddish brown and breaks with a shining fracture into angular and irregular fragments showing a compact or porous structure according to the heat employed in drying Scratched with a knife light reddish brown markings are exposed In the Calcutta market this form is known as *Pegu, Rangoon* or *Mogai Khair*, and is sold at R16 (£1 1*s* 8*d*) per maund (82⅔ lbs)

Janakpur

Janakpuri khair.—This is the pale catechu of Bengal trade, as already stated, in Gya, Chatra and Hazaribagh, and brought into Calcutta from Patna It is used extensively by the Kabirájs in medicine and by Marwaris and Bengalis for chewing purposes. It occurs in large masses or flattened cakes or balls and is of various qualities ranging from R28 to R23 (£1 17*s* 4*d* to £1 10*s* 8*d*) per maund (82⅔ lbs) The larger blocks are called *hathi pá* (elephant's foot) from their resemblance to the shape and colour of an elephant's foot Smaller forms are made into square cakes or rounded balls, both showing a laminated structure due to the presence of catechin

Tela khair

Tela or tele khair.—This is the dark or black cutch of Bengal brought from Patna to Calcutta and sold in various shapes It occurs in masses of a black or pitch like appearance having a shining fracture It is probably a by product in the manufacture of the light catechu There are two principal varieties of this cutch the name *tela* generally being applied to the crude article as it is imported and *mansarami* a refined cutch of better quality In the refining process the catechu is first dissolved in boiling water the liquid strained from impurities and then evaporated by boiling The residue before it hardens is then cast into two shapes —

(*a*) round or *bélguli* (from *bél* the fruit of Ægle Marmelos which it resembles) and
(*b*) square, called *chauk chaukhabi* or *kalagaran*

Tela cutch is the cheapest kind sold costing only R12(16*s*) per maund (82⅔lbs) It is this kind which is used with concrete in preparing the roofs of houses as it is supposed to enter into combination with the lime and render the composition more durable *Tela khair* is also moulded into various ornamental articles and made as presents offered at wedding ceremonies * It is on account of its low price used by the poorer classes for edible purposes

Pale cutch

Pale cutch of the United Provinces and Kumaon—Is lighter in colour than that of Bengal and contains abundance of catechin

Cawnpuri cutch

Cawnpuri cutch—Is a variety of Kumaon cutch and occurs in irregular or rectangular cakes about 2 inches square dull pinkish fawn inside, and breaking with a tough earthy fracture showing a laminated structure The price is R32 (£2 2*s* 8*d*) per maund (82⅔lbs), and as its name implies is exported from Cawnpur

* See "Some Instances of Vegetable Pottery *Journal of the Asiatic Society of Bengal*, Vol II, Pt 3 (1906) page 65

CUTCH TRADE FORMS

Chana makhan khair

Chana makhan khair—Literally "curd and butter cutch," is a pure form of Kumaon cutch used largely in the Benares district It occurs in rectangular blocks, somewhat smaller in size than the Cawnpur kind, and is of a more uniform consistence and paler colour It is the dearest cutch in the market as it sells for R35 to R40 (£2 6s 8d to £2 13s 4d) per maund (82⅔ lbs), and is used almost exclusively for chewing purposes

Gambler

Gambier—This well-known article is imported from Singapore and is employed in dyeing as well as for chewing by Bengalis It is the pale or (from its shape) cube catechu of commerce, but its most approximate term is gambier, which distinguishes its origin from that of the numerous Indian varieties of cutch Gambier is called *papri*, *gala* or *goolt khair* in the Calcutta market where it sells for R17 (£1 2s 8d) per maund (82⅔ lbs)

Prepared or mixed cutch.

Prepared or mixed cutch—In addition to the simple extracts various preparations are locally sold in the market A peculiar mixture named *gora khair* is made in Calcutta from gambier, Janakpuri cutch and *lál mati* (red earth) This appears as a tough extract of a reddish colour and is invariably wrapped in leaves of the *sál* tree (Shorea robusta) It is also called *sálpatawala* from the fact of these leaves being used as a covering The soft extract is sold at R12 (16s) per maund (82⅔ lbs), it ultimately dries to a hard cake

Kaya khair

Kaya khair—This is another preparation of cutch made by mixing together gambier and tela cutch, coriander, caraway, anise, cloves, cinnamon and cardamom with the flowers of the kaya or screw pine—*Pandanus fascicularis* (*Syn P. odoratissimus*). The moist mixture is wrapped in leaves of pandanus and allowed to dry at first for four or five days in the shade and finally in the sun It is prepared by the middle and upper classes of Hindus for domestic use and is not sold in the bazar The sticks of kaya khair are about 6 inches long by one inch in diameter

Bombay cutch.

Bombay cutch.—Catechu in balls This form consists of balls about as large as an orange, very hard and heavy, of a ferruginous aspect externally, brittle and black internally Another form occurs in a flattened condition, the cakes originally, in all probability, globular, and of about the same dimensions, but pressed out of shape before being perfectly dried The globular form is made in Kanara and, according to Dr Hamilton and Major Mackintosh, on the Malabar coast of which Bombay is the entrepôt.

Sir George Birdwood in "Bombay Products" describes four kinds of Bombay cutch—

(1) Kanchu or Dharwar, flat, round cakes, two inches in diameter and one inch thick, dark brown in colour, and preserved in bájri husks
(2) South Konkan, covered with paddy husks
(3) Khandesh, in angular grains, pale earthy brown internally, darker externally

CUTCH TRADE FORMS

(4) Surat, in irregular lumps of a light brown colour, from the size of a hazel nut to a walnut. This is the katha safed, the pale or white catechu of [illegible]

Specimens examined

The following is a brief description of the various samples of cutch exhibited in the Indian Museum and submitted to analysis:—

Sample	Description
336. Cutch, Forest Officer, Surat, Bombay.	Small lumps about 1 inch across, flat on one side, brown externally, dull fawn within; fracture earthy, showing white spots
342. Cutch, Forest Officer, Nasik, Bombay	Ditto ditto
887 Prepared cutch, Forest Officer, Tharrawady Division, Pegu Circle Burma.	Dark chocolate, dense fragments
858 Ditto ditto	Nearly black, shining fracture
859 Sha, ditto ditto.	Ditto ditto
876 Cutch, ditto ditto	Similar to 887
1436. Cutch, Forest Officer, Kumaon, North West *Provinces.*	Dark brown outside, light brown within; fracture earthy with laminated structure
2344. Soft cutch, Conservator of Forests, Tharrawady Division, Pegu Circle, Burma.	Ditto ditto
2345 Hard cutch, ditto ditto	Black irregular masses with shining fracture and air spaces
2346 *Ditto*, Conservator of Forests, Yaw *Division*, Pegu Circle, Burma	Ditto *ditto.*
2347 Soft cutch, ditto ditto	Very dark brown shining masses with reddish dust
2348. Black cutch, Conservator of Forests, Minbu Division, Pegu Circle, Burma.	Similar to 1436 in appearance
2349 Yellow cutch, ditto	Dark reddish brown or chocolate cakes
2350. Red cutch, ditto.	Reddish brown, dense, irregular and dull *fracture*
3361. Cutch, Assistant Conservator of Forests, Kamrup, Assam,	Black and reddish-brown, irregular fracture
3362 Ditto ditto	Black shining masses with porous structure
3391. Cutch, Pegu No 1, Burma, *from* Calcutta *market.*	Brownish black, shining fracture; covered with smooth leaves
3392 Ditto *No 2*, Burma, from Calcutta market	Dull brown, like 'clinkers,' containing visible *impurities*
3393 Cutch *No 1 var* Tela (Mansarami), from Calcutta market.	Dull earthy brown, containing visible impurities

CUTCH TRADE FORMS

Specimens examined

No.	Specimen	Description
3394	Cutch No 1, Janakpuri, from Calcutta market	Stratified masses showing black, chocolate and light brown layers
3395	Cutch No 2, Janakpuri, from Calcutta market	Ditto ditto
3396	Cutch No. 3, Janakpuri, from Calcutta market.	Ditto ditto
3397	Cutch *var* Tela (Telengar), from Calcutta market	Black coloured masses with whitish earthy covering, and lustrous fracture
3400	Cutch *var* (Chaukhabi), from Calcutta market	Brownish black dense lumps with leaf impressions
3401	Cutch (Salpatawala), from Calcutta market	Rectangular slabs 6 × 3 inches dark reddish brown or chocolate in colour with leaf impressions
3413	Black cutch, Conservator of Forests, Pegu Circle, Burma	Blackish cone shaped pieces; fracture lustrous
3428.	Yellow cutch, ditto	Flat cakes of about 1½ inch diameter, light yellowish brown outside and reddish brown within, fracture brittle, lustrous and porous
5029	Cutch, Conservator of Forests, Seoni Circle, Central Provinces	Blackish brown cakes 2" square by ⅜" thick One side with earthy impurities, as if dried on soil
5805	Cutch from Calcutta market	Dark reddish brown; fracture shining
6143	Cutch, Deputy Conservator of Forests Palamau Division Bengal	Square or oblong cakes, 2"×2" or 2"×3", shining dark brown stratified inside with light brown
6144	Ditto ditto .	Dull blackish masses
6145	Ditto ditto	Shining black masses, porous; impurities present
7806	Extract prepared in Glasgow by vacuum process	Coal black extract, shining fracture
9065	Catechu tannin from Conservator of Forests School Circle, Dehra Dun	Black extract with conchoidal fracture
9066	Catechin, ditto ditto .	Light pinkish brown masses with earthy friable fracture
10084	Extract, Tezpur, Assam.	Brownish black cakes, uniform, and shining fracture
10330	Ditto, Inspector General of Forests	Brownish black porous shining pieces
10580.	Ditto Deputy Conservator, S Circle Cent Provs.	Dull brownish black; fracture stratified
11036	Ditto, Conservator of Forests, W. Circle, Upper Burma	Reddish black uniform; fracture conchoidal
11844	Ditto Divisional Forest Officer, Kanara, W. Division	Balls with ashy white surface, blackish brown within

CUTCH TRADE FORMS

Specimens examined

No.	Description	Characters
11979	Black cutch Director, Land Records and Agriculture Burma	Brownish black shining, somewhat porous wrapped in leaves
13033	Kumaon Director, Land Records and Agriculture, United Provs	Small oblong cake, light brown, fracture stratified
13783	Madras through Board of Revenue	Brownish black, porous, leaf impressions
14405	Bombay Burma Trading Corporation Ld	Oblong cakes 2"×6"×1", brownish black, porous reddish brown when scratched.
16951	Hard cutch, Deputy Conservator Depôt, Agency Division, Rangoon	Reddish brown to blackish brown, enveloped in leaves
16959	Soft cutch, Deputy Conservator Pakokku Burma	Brownish black uniform, slightly porous
16960	Hard Cutch ditto ditto	Brownish black uniform dense
16961	Superior cutch ditto	Dark reddish brown
17058	Deputy Conservator Bahraich	Dark reddish brown lumps of about a pound in weight
17933	Yellow cutch Pegu Circle Burma	Reddish brown cakes
19794	Ditto Mandalay Burma	Brownish black, porous shining
19842	Ditto Angul Division	Dense chocolate like masses
21383	No 1, Deputy Conservator Southern Shan States Burma	Conical lumps like pastiles 1½ inch long light reddish brown
21383 1	No 2 ditto ditto	Square or oblong cakes 1 ×½", light reddish brown

CHEMICAL COMPOSITION

Chemical Composition —The active astringent principles of cutch are a tannin formerly known as catechu tannic acid and a crystalline body named catechin The value of cutch as a dyeing and tanning agent depends upon the amount of these two substances, while at the same time they are a measure of its suitability as a medicine

Davy 1803

Sir Humphry Davy in 1803 was one of the first to investigate the chemical properties of catechu and his results were communicated to the Royal Society of London in a paper, entitled "An account of some experiments and observations on the constituent parts of certain astringent vegetables and on their operation in tanning" By Humphry Davy Esq, Professor of Chemistry in the Royal Institution The paper was communicated by the Right Honourable Sir Joseph Banks, Bart, K C B, P R S and was read February 24th, 1803 (Philosophical Transactions, Volume 93 252) In the third section of his paper he discusses his experiments and observations on Catechu or Terra Japonica.' The material was rightly described as an extract from the wood of a species of Mimosa (the

CUTCH, CHEMISTRY OF

former name for Acacia) found in India There were two kinds of extract known in England at that time, one from Bombay of a uniform texture and of a red brown tint, and the other from Bengal of a paler and more friable character and with a fracture presenting strata of chocolate and red brown colours It may be of interest to quote Davy's analyses of these two samples

	Bombay	Bengal
Tannin	54 5	48 5
Extractive matter	34 0	36 5
Mucilage	6 5	8 0
Res due chiefly sand	5 0	7 0
TOTAL	100 00	100 00

The tannin was estimated by precipitating the infusion with a solution of gelatin and weighing the compound In the extractive matter' was recognised what we now know as catechin by its sweet and astringent taste, its greater solubility in boiling than in cold water, and the colour of its solution turning red on exposure to the air Davy observes that the pale catechu is that most sought after in India and the peculiar sweetish taste of the extractive matter (catechin) which it contained probably rendered it so agreeable to the Hindus for the purpose of chewing with betel nut

Napier 1875

In a Manual of Dyeing James Napier (1875) there are given analyses of samples of catechu in the European market derived from Bombay Bengal and Malabar The Bombay sample yielded 52 per cent of tannin Bengal 49 5 and Malabar 45 8 per cent The balance is returned as gum extractive and colouring matter and impurities

Analyses by Prof Proctor.

To ascertain if there was any uniformity in the composition of cutch I applied to Professor H R Proctor of Leeds and he obligingly placed at my disposal the following analyses of extracts from Acacia Catechu —

	Tanning matter	Non tanning matter	Insoluble	Water
Dark Cutch	58 9	1 0	19 1	12 0
White cutch of kath	72 2	5 8	6 8	14 2
Yellow cutch Pegu Burma	69 2	8 0	10 4	12 4

Professor Proctor also forwarded some figures of recent analyses of extracts which were supposed to be derived from Acacia Catechu

CUTCH CHEMISTRY OF

Analyses by Prof Proctor

Mark	Tanning matter	Non tanning matter	Insoluble	Water	Tanning on dried extract
Drysdale	42.2	25.6	7.6	24.6	55.8
Salatiga	30.8	29.7	2.2	37.3	49.1
B B Flag 1	62.6	12.0	10.0	15.4	73.9
B B Leurel II	59.6	15.5	7.6	17.3	72.0
B Star 3	46.5	23.2	14.9	15.4	54.9
41	41.5	17.6	4.6	36.3	65.1
42	29.6	18.8	31.1	20.5	37.3
Pegu	30.0	35.4	0.7	24.9	39.9
Assam	46.4	34.3	2.7	16.6	55.6
Ame	45.7	19.8	15.8	18.7	56.2

The following tables give the result of the analyses of several samples of cutch exhibited in the Indian Museum Their appearances have been described on pages 37 to 39 —

Analyses made in Calcutta.

Indian Cutch

	Water	Tannin	Catechin	Non Tan sol	Insol org	Ash	Spirit extract
336 Surat Bombay	14.0	37.0	16.0	28.9	2.5	1.6	77.8
342 Nasik „	13.4	37.4	15.6	26.8	4.0	2.9	78.5
11844 Kanara, Bombay	11.6	39.8	3.9	34.7	4.5	5.5	60.7
1436 Kumaon United Provinces	12.0	42.9	33.0	3.2	2.6	6.3	67.3
13033 „ „ „	14.1	39.1	40.8		2.5	4.9	78.8
3393 Tela, Mansaram United Provinces	9.7	17.3	1.7	29.8	14.0	27.5	27.0
3394 Janakpuri No 1 United Provinces	13.0	40.7	5.8	24.0	2.8	2.7	68.9
3395 Janakpuri No 2 United Provinces	13.5	36.8	17.3	28.4	3.5	1.5	69.6
3396 Janakpur No. 3 United Provinces	12.5	38.8	17.2	26.4	3.3	1.8	75.1
3397 Telangir United Provinces	8.0	30.1	2.0	29.6	4.6	25.7	49.0
3400 *Chaukhabi, United Provinces*	9.2	27.6	4.5	22.8	9.6	26.3	45.8
3401 Salpatawala No 3 United Provinces	8.0	15.2	4.0	5.2	9.3	38.3	32.0
9065 Catechu-tannic acid United Provinces	11.7	43.3	2.5	32.5	4.9	5.1	55.6
9066 Catechin United Provinces	13.3	8.7*	36.8	10.9	20.4	9.9	59.6
17058 Babraich „ „	11.5	40.2	13.4	29.8	1.1	4.0	80.0
5029 South Circle Central Provinces	1 9	30.3	12.3	33.7	5.2	6.6	67.7
10580 „ „	11.1	29.7	12.0	35.0	6.8	5.4	57.7
6141 Palamau *Bengal*	12.8	36.4	18.3	19.3	5.5	7.7	68.1
6144 „	10.4	29.5	3.4	33.4	5.6	18.7	32.0
6145 „	10.7	33.1	1.2	36.7	3.7	14.6	43.6
19842 Angul Bengal	12.1	46.0	4.5	31.2	1.5	4.7	60.0
3361 Kamrup Assam	10.7	50.0	9.7	23.1	4.3	2.2	80.0
3362 „	11.0	45.2	2.8	34.9	2.8	3.3	66.0
10084 Tezpur „	11.6	42.5	11.6	26.0	5.4	3.5	77.9
13783 Madras	12.5	45.5	5.6	29.6	2.9	3.9	69.5
89781 Kurnool *Madras*	13.0	45.0	3.5	31.8	2.2	4.5	62.0

* Estimated by another method tannin by hide powder 34.8

CUTCH CHEMISTRY OF

Analyses made in Calcutta.

Burma Cutch

	Water	Tannin	Catechin	Non tannin sol	Insol org	Ash	Spirit extract
887 Tharrawaddy	11.8	46.1	5.2	33.0	2.0	1.9	77.8
888	11.9	48.6	5.5	28.3	3.2	2.5	76.0
889 " Sha	12.3	44.5	12.0	25.8	2.6	2.2	69.0
896 "	10.9	54.6	3.6	[illegible]6.3	[illegible].2	2.4	76.9
2344 Soft	10.5	50.2	4.6	[illegible]5	4.1	[illegible]	75.5
2345 Hard	10.1	49.7	2.8	31.0	3.0	2.4	73.0
2346 Yaw Division Hard	11.5	40.4	[illegible]	40.0	3.1	2.8	62.0
2347 Soft	10.3	46.8	2.4	37.2	1.5	1.8	71.6
2348 Minbu, Black	7	9.4	10.1	10.0	3.7	49.6	30.3
2349 " Yellow	11.2	41.7	5.8	38.2	.4	2.7	6[illegible]7
2350 " Red	11.4	45.5	5.1	33.4	.7	3.9	70.7
3391 Pegu No 1	11.5	45.2	2.1	32.7	3.4	2.1	69.1
339 No. 2	9.5	19.7		[illegible]8.5	14.2	28.1	32.3
3413 " Black	10.9	40.3		44.9	1.9	2.1	69.7
3428 Yellow	11.2	42.6	13.6	0.4	.4	1.8	73.5
5805 Burma (Calcutta Bazar)	10.7	44.3	3.5	34.1	1.9	3.5	66.3
7806 Vacuum made	10.9	45.9		34.9	1.9	3.4	68.8
7964 Old sample	8.4	14.1	2.6	[illegible]6.1	12.0	36.8	21.7
10330 Pegu Cutch	10.5	44.2	6.8	32.3	3.6	2.6	65.5
11036 W Circle Upper Burma	11.4	47.5	2.5	33.5	3.5	1.6	70.0
11979 Black Cutch	10.6	45.7	2.4	35.3	3.7	2.5	67.0
14405A Rangoon	11.5	40.1	4.0	40.0	2.6	1.8	69.0
14405B	10.6	46.2	5.9	42.1	3.3	2.5	75.0
14405C "	11.6	43.7	4.3	35.6	2.0	2.8	63.0
14405D "	11.0	41.4	3.3	37.6	2.9	3.8	69.8
14405E "	12.0	31.8	1.1	35.9	6.6	12.6	47.4
16951 Hard	1[illegible].6	43.2	2	38.1	1.3	2.8	67.4
16959 Pakokku, Soft	11.4	47.2	1.8	34.5	[illegible].4	2.7	62.0
169[illegible]0 Hard	12.9	52.2	2.4	28.2	2.[illegible]	[illegible].1	68.5
16961 " Superior	11.3	54.8	4.8	25.2	1.3	2.6	71.2
19794 Mandalay	11.5	38.7	9.4	33.5	2.8	4.1	58.2
2[illegible]383 Shan States	13.6	35.6	8.9	37.5	2.0	2.4	64.8
21383 "	14	33.5	13.2	35.1	1.1	3.0	62.5
25377 Rangoon (vacuum made)	11.2	41.0	11.7	33.1	1.1	1.9	72.1
Average of 31 good samples	11.4	44.3	5.0	34.0	2.4	2.9	70.0

Methods of analysis.

The methods employed in examining these samples may be briefly stated

The tannic acid or tannin was estimated by hide powder The prepared hide powder was digested with chrome alum and washed till free from sulphates and strained The moist hide was then mixed with a measured quantity of tannin liquor previously prepared by hot water, and shaken together until the tannin was absorbed from solution The weight of total solids of an aliquot part of the liquor compared with that of the original extract gave the amount of tannin It was noticed that catechin although not precipitated by gelatine is absorbed by the surface of hide It is somewhat misleading to regard the tannin recorded in the above tables as pure as in several cases they include some, if not all, of the catechin

The catechin was estimated by powdering a weighed quantity of the cutch with pumice and digesting in acetic ether for twenty four hours The extract *was evaporated to dryness a small quantity of* hot water added and crystals left to form After standing for one

or two hours the crystals were collected on a filter, washed and weighed This method adopted by Greshoff in estimating gambier gave excellent results when only one or two per cent of catechin was present, and ensured the minimum amount of decomposition

CUTCH CHEMISTRY OF

Method of analysis.

The organic matter insoluble in hot water, the ash and moisture were determined in the usual way The figures for non-tanning soluble matter were calculated by difference

As might be expected there is a greater variation in the composition of samples obtained from different sources in India than there is in trade samples of cutch imported into England. The tannin in these tables ranges from 14 1 to 54 8 per cent, and the catechin from nothing to 40 8 The lower valuations are due to the impurities present either added through carelessness or fraud or to improper manufacture When the mineral matter constitutes one quarter, one third and one half of the extract there is evident adulteration and such extracts can have little value either as a dye, a medicine or a masticatory

Variation in amount of 1 Tannin, 2 Catechin 3 Mineral, matter

There is no rule respecting the relation between the tannic acid and catechin In the Burma samples there is an average ratio of 9 1, while in the Indian samples the ratio extends from 1 1 in the Kumaun samples to 28 1 in a Rangoon cutch The variations that may be expected in manufacture may be conveniently studied in observing the composition of the "Catechu tannic acid and "Catechin (9065, 9066) prepared by separating the crystalline and non-crystalline portions of a batch of ordinary Oudh cutch

Ratio of tannic acid to catechin.

There is a remarkable similarity of composition in ten of these samples, where a rather high amount of catechin is associated with a low amount of tannin These include specimens from Surat and Nasik in Bombay, the Janakpuri cutches Bahraich in the United Provinces, the Central Provinces, Palamau in Bengal, Tezpur in Assam and the Shan States in Burma Although so widely distributed they exhibit an average of 37 per cent of tannin and 15 per cent of catechin or a ratio of 2 4 1 They hold therefore an intermediate position between the ordinary commercial cutch of Burma and the crystalline cutch of Kumaon and are probably yielded by the trees botanically referred to as A. Catechu and A Sundra

Under the head of 'non tanning soluble matter" must be included mucilage or gum of the arabin class This was detected by examining the residue left after exhausting the cutch with alcohol The residue soluble in water was precipitated with alcohol two or three times until free from colouring matter, when it gave the reactions for gum arabic with the usual tests

Mucilage.

In some samples of cutch giving much non-tanning matter caramelised products due to decomposition of the tannic acid were regarded as the ingredients

Allen records the presence of 0 5 per cent of sugar in a sample of cutch In one of the Janakpuri specimens I obtained as much as 1 2 per cent

Sugar

CUTCH ADULTERATION OF

Adulterants of cutch.—In dealing with the composition of cutch it is necessary to allude to the various substances which are occasionally added to adulterate it. Mr. Branthwaite of the Forest Department mentions the decoction of the bark or wood of the following trees which are sometimes used in Burma to mix with it. (*Indian Forester*, 1892.) *Than* (Terminalia Oliveri), *taukkyan* (Terminalia tomentosa), *lein* (Terminalia bialata), *hyangah* (Terminalia Chebula), and to a less extent *pyinkado* (Xylia dolabriformis) and *pyinma* (Lagerstrœmia Flos-regina). Also *ngabo* (Odina Wodier), according to Mr. Corbet.

By mixing barks

All of these barks are more or less astringent and according to our present knowledge would be considered substitutes rather than useless adulterants of a tannin extract. For instance, the extract of the bark of Terminalia Oliveri has been shown to be very rich in tannin. Professor Dunstan obtained 68·27 per cent. of tannin in the dried extract, and Professor Proctor of Leeds found the tannin to agree in its reactions with that from the wood of Acacia Catechu. Professor Hummel, however, reported that the colouring matter was inferior and when submitted to the test of calico printing it gave very poor results. It is, therefore, more suitable as a tan than a dye. Where the tree is plentiful along the Irrawaddi below Zigyang, the fishermen employ the extract to colour their nets.

Re melting in Rangoon

Chinese brokers in Rangoon who have nearly all the trade in their hands, do not own to this adulteration, but they confess that they re-melt soft cutch mixing it with hard cutch, and re pack it in boxes. This is probably the time at which adulteration takes place, as it is extremely easy to incorporate all manner of impurities into a soft black extract. It has been reported that for three years an individual in Burma carried on a lucrative trade by purchasing pure cutch in the district and boiling it up again with 25 per cent. of godown sweepings. This was said to fetch as high a rate in the home market as the best cutch shipped from Burma.

Rubbish mixed in

Allen states that cutch is not infrequently adulterated with starch sand and blood among other materials, and Jessart reports that he has met with an admixture of 60 to 70 per cent. of ferrous carbonate. The *sdlpatauala* cutch, however, contains red earth as a recognised ingredient.

In the foregoing tables of analyses a large amount of mineral matter preponderates in a few of the specimens. In the Indian samples 6 in the 24 or 25 per cent. would be rejected for this reason alone, but in the Burmese samples only 3 in 34 or 8.8 per cent. were unduly loaded with ashes.

Tests

To test for adulterants.

A very simple test, besides the estimation of tannin and catechin, is the solubility of catechu in 90 per cent. alcohol. This is readily performed by digesting one or two grams of the finely

powdered drug w[illegible]h occasional shaking for [illegible] hours. The [illegible] [illegible] is then f[illegible]ered the marc washed [illegible] [illegible] the [illegible] extract evaporated to [illegible] [illegible] dryness at [illegible] C. [illegible] through the tables of analyses [illegible] [illegible] alcoholic extract is 70 per cent [illegible] [illegible] between 60 and 70 per cent, [illegible] contain less than 60 per cent

In the German Pharmacopœia the above test is directed to be applied in a different manner. It requires that the residue remaining after extracting catechu with alcohol should not exceed 15 per cent. This figure allowing for 15 per cent of moisture is equivalent to 70 per cent. of dried extract. [illegible] Dieterich in 191[illegible] [illegible] that this requirement is too stringent, and recommended 3[illegible] per cent. as the limit of insoluble residue. He discovered that the residue from six samples of Pegu catechu varied from 26.71 to 41.86 per cent. His opinion therefore was that catechu conforming to the present official requirement was rarely found in the market

In the light of the examination of over sixty samples of Indian catechu it is clear that the limitation of the Indian and Colonial Addendum of the British Pharmacopœia [illegible] [illegible] per cent of extract is too high and that these figures might be altered to between 60 and 70 per cent

With regard to the ash limit of catechu the Indian and Colonial Addendum fixes the maximum at 6 per cent and the United States Pharmacopœia at 5 per cent. Since the average percentage of the ash of a large number of samples of Burmese cutch was found to be only 2.9, there should be no difficulty in obtaining commercial cutch with less than 5 per cent of mineral matter

CATECHU VERSUS GAMBIER Chemical differences

The relation between catechu and gambier —So far we have been dealing with catechu or cutch, an astringent extract made from the wood of Acacia Catechu. In the Malay States and Borneo there is manufactured an extract from a plant called Uncaria Gambir. This has similar properties and it has often been reported that the chemical composition of the two substances is identical as they both contain tannic acid and the crystalline principle catechin. The catechins separated from these two plants were for many years considered the same, but A. G. Perkin (*Journal of the Chemical Society*, XXIII, 1904, 746), after studying their derivatives, has observed certain differences. He points out that gambier catechu contains a catechin $C_{15}H_{14}O_6$ melting at 175°—177°, the pentabenzoyl derivative of which melts at 151°—153°, while the catechin of Acacia Catechu $C_{15}H_{14}O_6$ melting at 204°—205° gives a benzoyl compound melting at 181°—183°. Notwithstanding these minor differences the researches of Perkin and Yoshitake, and Kostanacki Tambor and Krembs show that there is an extremely close chemical relationship between the catechins derived from different sources. Attention should be drawn to the interesting fact in vegetable physiology that the extract of the wood of a leguminous

CATECHU VERSUS GAMBIER

tree has such a remarkable resemblance to the extract made from the twigs of a rubiaceous shrub

Analyses of Gambier

Analyses of gambier according to Proctor shew a tannin content of 36 to 40 per cent Allen records a percentage of 47 18 M Greshoff, Haarlem has recently (1905) given the following results of an analysis of an unadulterated gambier Tannin 24, crude catechin 46, crystalline catechin 30—35, insoluble 7 6, water about 15 ash not more than 5 per cent

The following two analyses are given of pale cube gambier as sold in Indian bazars and they are comparable with the tables of analyses of cutch given on page 41 —

	Water	Tannin	Catechin	Non tan sol	Insol	Ash	Alcoholic extract.
Calcutta	11 4	27 7	30 0	19 9	7 1	3 9	79 9
Bombay	13 5	32 4	18 2	22 9	9 4	3 7	77 4

They therefore approach in composition the Kumaon and Janakpuri cutches of Northern India

To distinguish the two

As a means of distinguishing between catechu and gambier, Dieterich in 1896 recommended the following fluorescent test 3 grams of gambier are dissolved in 25 cc normal caustic potash and 100 cc of water, 50 cc benzene (700) are then added and the whole agitated in a separating funnel On allowing it to stand the upper benzene layer shows a green fluorescence **Acacia catechu** does not show this reaction

Similar uses in the East

Notwithstanding the minor differences between the two extracts as a practical manner cutch and gambier are used for similar purposes in the arts and in medicine Evidence of this is traced in the history of gambier manufacture in Malaya For several years the Malayas used *cate* or cutch the product of the Indian **A. Catechu,** to chew with betel nut but this became too expensive and they had to resort to various substitutes Before 1750 they discovered the way of making cakes of the extract of the gambier plant, and this extract has now almost entirely displaced Indian cutch in the Straits Settlements and elsewhere in the Far East

In the Calcutta bazars Janakpuri khair (cutch) and *papri khair* (gambier) are sold side by side in all the grocers and druggists shops The first is somewhat darker and is considered more bitter than the imported gambier, and the retail price is somewhat higher The preference which is shown for one kind would seem to be merely a matter of taste for the consumer and a question of cost for the buyer

Prepared catechin

Catechin is sometimes prepared locally from cutch and gambier for edible purposes mixed with betel nut In Calcutta the moist crystals are sold as *gala khair* This is prepared by taking two parts of Papri and one part of Janakpuri, boiling them in water and straining through a cloth when cold The residue on the cloth after pressing is kept for sale The eaters of *pan* thus sometimes prefer an article almost entirely free from tannic acid

Catechu in medicine

CATECHU VERSUS GAMBIER

Catechu from Acacia Catechu was recognised as an official drug in the London Pharmacopœia of 1721 The first British Pharmacopœia of 1864 included both catechu and gambier, the former being called Catechu nigrum and the latter Catechu pallidum

In medicine

The inclusion of the two drugs was considered unsatisfactory as pharmacists were left to use whichever they pleased in making the infusion, tincture and compound powder Professor Bentley pointed out that the infusion and tincture would vary, especially in colour, according to the kind of catechu employed, and this would lead the patient to the belief that his medicines had been wrongly prepared With deference to this opinion Black catechu was discarded in subsequent editions of the British Pharmacopœia, and the Pale catechu was retained In the Pharmacopœia of India, 1868, Black catechu is described and is prescribed for the preparation of the infusion, tincture and compound powder In this work Pale catechu is described to be used for making catechu lozenges and is said to possess the advantage of being more soluble than Black catechu though the properties are similar In the Indian and Colonial Addendum (1900) to the British Pharmacopœia Black catechu or Catechu nigrum is again promoted to an official position and is directed to be employed in making all the preparations

In the United States Black catechu until recently has been preferred to Pale catechu In the 16th edition (1889) of the Dispensatory of the United States the extract of the heart-wood of Acacia Catechu is referred to as ' proper catechu, and gambier is placed among the catechus not recognised by the United States Pharmacopœia The editor then proceeds to describe in detail the varieties of the official catechus to be found in the market of Philadelphia and designated as Plano-convex catechu or cake catechu Pegu catechu catechu in quadrangular cakes, Pale catechu and catechu in balls

In the United States Pharmacopœia for 1900 gambier or as it is called gambir, replaces catechu of the Pharmacopœia of 1890 The authors of the National Standard Dispensatory state that catechu is official in nearly all pharmacopœias though all do not agree in specifying this substance The name catechu is retained for it In America we are informed that very little catechu from Acacia Catechu is now to be found in the market, showing that an entire change of opinion with regard to Black cutch has established itself

Areca Catechu.

EXTRACT OF ARECA-NUTS

Former writers on Indian cutch have occasionally referred to an extract made from the nuts of Areca Catechu and used as a masticatory, but there is very little evidence to show that this extract

EXTRACT OF ARECA-NUTS

is a marketable article at the present time Ainslie (*Materia Medica*, Vol I, 65) describes two substances said to be prepared from the betelnut palm the first was of a light brown colour called *cuttacamboo* and brought from Pegu, the second was of inferior quality, almost black in colour, called *cushcuttie* and imported from Acheen These were no doubt confounded with Pegu cutch and gambier B Heyne (*Tracts Historical and Statistical on India*, 1814) gives a circumstantial description of the manufacture of an extract from Areca Catechu in Mysore Two products were obtained, one with a yellowish-brown colour and earthy fracture and the other, called *kassu*, of a black colour and mixed with impurities Pereira (Vol II, Part II, 341) gives Heyne s account of the origin of *kassu* and speaks of it as a product of Ceylon In a letter from an Assistant Surgeon at Colombo in the year 1838, *kassu* is more properly supposed to be derived from Acacia Catechu and produced in India Mohideen Sheriff made an unfounded assertion when he suggested that the cutch of South India was made from areca nuts On the other hand, Blume who had a wider experience denies (*Rumphia* II, 67) that an extract such as catechu is procured from the nuts Baden-Powell in "Punjab Products alludes to an extract called *kossa* made from areca, and it is said that a sticky extract used for varnishing wood is sometimes prepared in Bombay, but there is no definite information now existing regarding the manufacture

Made in Mysore

Made in the Punjab

There is no doubt that in former times much confusion existed with regard to the so-called extract of areca and among some the confusion still exists About a year ago a sample of cutch labelled Areca Catechu was sent from Madras to the Reporter on Economic Products for valuation, and from its appearance and composition, especially in its yield of catechin it possessed all the characters of cutch from Burma From other descriptions of cutch sold in Madras, it appears that Burmese cutch is now largely supplied in the shops

Burmese cutch in Madras

A sample of extract of Areca Catechu in the Indian Museum, designated as *Pakku*, was obtained from Trivandrum, Travancore It has the dark brown appearance of ordinary cutch, affords 40 per cent of tannin, but no catechin and yields only 49 2 per cent of alcoholic extract It, therefore, differed in some respects from ordinary cutch and its origin is being enquired into It seems highly improbable that these nuts could be used for the purpose of making an extract, considering the price of betelnuts in the market, and the demand that always exists for them in the raw and prepared state They are habitually eaten with ordinary forms of cutch and gambier, and sometimes they are prepared by steeping them in a decoction of the cutch and allowed to dry, but at present we know little about the relative composition of the numerous trade samples of areca, and the whole subject is worthy of investigation

Areca extract made in Madras

Trade Statistics

TRADE IN CUTCH

A few references to the production and export of cutch and gambier will throw much light on the future of their respective markets. Gambier holds a firm position and is exported to double the extent of cutch, while the latter is falling off in production and trade with foreign countries.

Indian cutch is manufactured principally in Burma and about 97 per cent. of the exports from British India are shipped from Rangoon. During the years from 1869 to 1872 the following amounts were exported to the United Kingdom:—

1869	1870	1871	1872
2,257	5,252	4,335	5,240 tons

In 1869-70, 10,782 tons were exported from Burma valued at £193,602. In 1872 the value of the cutch imported into the United Kingdom was estimated at £124,458. Statistics of more recent times show that for the five years ending 1895-96 the average exports from British India were 190,450 cwts (9,522 tons), valued at R34,12,842 (£227,522 16s). For the five years ending 1904-05 the average annual exports were reduced to 82,632 cwts. (4,139 tons), valued at R14,77,132 (£98,475 9s 4d). The price per hundredweight is R17-12 (£1 3s 8d). Last year the United Kingdom took one-half and France one-sixth of the exports, while Germany, the United States, Holland, China and Ceylon took smaller quantities.

Trade in Gambier.

The trade in gambier is much larger than that of cutch. This article has been exported from Singapore for several years. In 1839 we find that over 5,000 tons were sent to England from this port. In 1872 the imports into England reached 21,000 tons valued at £451,737. Singapore exported in 1871 no less than 34,248 tons of gambier. In 1876 the amount rose to 50,000 tons and in 1877 it fell to 39,000 tons. Recent statistics show that in 1903 32,083 tons of block and 2,823 tons of cube gambier were sold at Singapore. In 1904, 22,246 tons of block and 2,563 tons of cube were sold and in 1905, 29,921 tons of block and 3,445 tons of cube. About 1,300 tons of gambier from the Straits is imported annually into India, chiefly at Calcutta, at R17-8 (£1 3s 4d) per cwt or R356 (£23 14s 8d) per ton. This amount is almost entirely consumed in the country.

Conclusions

CONCLUSIONS

The foregoing notes deal with two products *differing* in botanical and geographical origin, yet having in many respects similar properties. They *have long* enjoyed a reputation in medicine and have rivalled *one another* in their claims for admission into the Pharmacopœias *of western nations*, the pale catechu or gambier is, however, now taking the *lead* as the favourite drug

CON-CLUSIONS

The reasons for this are not far to seek The khair tree (**Acacia catechu**) occupies reserved areas under the Forest Department in two or three centres in Burma, Kumaon in Northern India, and perhaps Bombay, and the manufacture is restricted owing to the limited number of trees available for felling On the other hand, gambier is obtained from a crop the cultivation of which can be readily extended as the demand for the manufactured article increases, and the uniformity of composition and greater outturn of the product appeal favourably to purchasers Indian cutch, especially that of Burma has a standard of its own, and will continue to command a market on account of the high quality of the extract in tannin By a system of natural reproduction in the forests in localities indicated in the above notes and by careful attention to the manufacture, cutch of India should long remain a rival of the gambier of the Straits in dyeing and tanning industries and in medicine

G I C P O—No 719 R E P—21-9-1906—2500—L J D

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Reporter on Economic Products to the Government of India, Calcutta.

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions Contributions or corrections and additions will therefore be most welcome.

In order to preserve a necessary relation to the various Department of Government, contributions will be classified and numbered under certain series Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series, those on Forestry in the Forest Series Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series.

This sheet and the title-page may be removed when the subject matter is filed in its proper place, according to the letter and number shown at the bottom of each page



(Vegetable Product Series, No. 96.)

THE

AGRICULTURAL LEDGER.

1906—No. 4.

PSOPHOCARPUS TETRAGONOLOBUS
(GOA BEAN.)

GOA BEANS IN INDIA.

By I. H BURKILL, *Officiating Reporter on Economic Products to the Government of India*



CALCUTTA:
OFFICE OF THE SUPERINTENDENT, GOVERNMENT PRINTI…
1906.

The objects of THE AGRICULTURAL LEDGER are—

(1) *To provide information connected with agriculture or with economic products* in a form which will admit of its ready transfer to ledgers;

(2) To secure the maintenance of uniform ledgers (on the plan of the Dictionary) in all offices concerned in agricultural subjects throughout India, so that references to ledger entries made in any report or publication may be readily utilised in all offices where ledgers are kept.

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To facilitate the preparation of an index to THE AGRICULTURAL LEDGER the following arrangements have been made, commencing with 1900—

All papers published will be paged, irrespective of subjects, into an annual volume

The annual paging will be given on the top of the pages But to permit of a continuation of the classification into the various series hitherto observed, a further folio will be shown at the bottom of the pages. This will be preserved throughout each series and be continued for several years, until in fact sufficient material in each series has been accumulated to constitute a fair sized volume.

At the end of the year a printed index and title-page will be issued for the annual volume, and after a period of, say, five years an index and title page will be issued for each series. It has been found that many persons subscribe for a certain series only and do not care to receive the others. The new arrangement, while permitting of the formation of an annual volume, will at the same time retain the serial classification

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THE AGRICULTURAL LEDGER.

1906—No 4.

PSOPHOCARPUS TETRAGONOLOBUS

(GOA BEAN)

GOA BEANS IN INDIA

By I H BURKILL, *Officiating Reporter on Economic Products to the Government of India*

THE GENUS PSOPHOCARPUS

Its useful species

In the genus **Psophocarpus**, Agriculture or Horticulture finds two serviceable plants, the one is **Psophocarpus palustris**, a plant widely cultivated in Africa and introduced into South America, the other is **Psophocarpus tetragonolobus**, which is cultivated *from Mauritius to New Guinea Possibly the whole genus is to be* reduced to these two widely grown beans wh ch d ffer thus —

Flowers on short stalklets several—**P. palustris**
Flowers on long stalklets fe v larger—**P tetragonolobus**

Both have been grown in Ind a but **P. palustris** is not gro vn now

First report on P tetragonolobus

P. tetragonolobus was the first of the two to come to Furopean knowledge Rumpf who lived in Amboyna from 1653 to 1702 drew it and described it. ' *This Phaseolus gives* ' *he says (Herbarii* Amboinensis liber ix cap xxi Amsterdam 1750 tab cxxxii) ' tuberous roots as well as ed ble beans Its flowers are the largest of all the Phaseoli within pale blue w thout dun-coloured they are few and only open before midday and do not produce much fruit The beans are quadrangular about a hand span long or sometimes a foot long hardly a finger breadth broad, with membranous frilled wings at the margins pale green at first—then smoke colour and hard When old the pods have narrowed w ngs quadrate and at maturity they open in the sun with much crackling The root has the form of an oblong

HISTORY OF PSOPHOCARPUS

turnip In Latin the plant is called Lobus quadrangularis, in Malay and the Javan language *Botor*, ... in the language of Banda *Culebet*, in that of Bali *Caloncan* Botor is derived from the Arabian Bair which means a lobe . . *The bean is produced in Amboyna* and elsewhere apparently, in Java and Baleyn, but is rarely cultivated

' Its tender green pods, before they harden into the beans, are cooked, cut into short segments, like other such beans .. The ripe beans can hardly be eaten as they are said to make the head heavy. ... The root is eaten boiled and for the purpose is dug before the bean ripens, after which it is less pulpy and dry"

Linnaeus name

Rumpf's plant, which is figured, is undoubtedly Psophocarpus tetragonolobus. Linnaeus, when he came to range and catalogue all things known to have life, called it Dolichos tetragonolobus. Necker, who still had no more information than old Rumpf afforded, in 1790 changed the name to Psophocarpus tetragonolobus, which name we now adopt

Origin of accepted name

First record for China

In 1790 Loureiro stated that it is grown in South China It is not unlikely that he meant the neighbourhood of Canton (*Flora Cochinchinensis*, p 437)

First records for India

In 1799 according to Roxburgh it was introduced into the then twelve years old Botanic Garden of Shibpur, Calcutta, and it continued to be grown there for the Superintendent's table for some time (*vide* Roxburgh's *Hortus Bengalensis*, 1814 p 55) Roxburgh did not know the native country of the bean, a circumstance which indicates surely that it had been grown in India before his time Most likely Roxburgh obtained his seed in the first instance from local sources It can also be proved to have been in cultivation at Madras about this time; for Wallich who in 1828, distributed herbarium specimens from the Calcutta Botanic Gardens collected by Buchanan-Hamilton (in charge 1814-15) and by himself, also distributed specimens collected for him from Madras

First record for Reunion.

In 1820 Psophocarpus tetragonolobus was in cultivation in the French island of Réunion (Breon, *Catalogue des plantes cultivées aux jardins botanique et de naturalisation de l'île Bourbon*, p 51) Breon did not know its origin, and this indicates that it had been in Réunion before the foundation of an experimental garden there Had Breon received it from the Calcutta gardens, with which an exchange had been established, it would have been acknowledged

Found in Burma.

In 1826 Wallich found the plant to be cultivated (or run wild) in Lower Burma

In 1825 Seringe, who wrote the account of the pea family in DeCandolle's Prodromus, described Rumpf's plant, and remarked that Du Petit Thouars had obtained a similar, but smaller plant from stream sides in Madagascar This remark would seem to be the first mention of Psophocarpus palustris.

First mention of P palustris.

In 1826 Desvaux, stimulated by the work of Seringe to publish his observations on Leguminosæ, described Psophocarpus palustris from damp places in Senegal, West Africa (*Annales des Sciences Naturelles*, Series 1, ix, p 420) The same plant was again described by Guillemin, Perottet and Richard in 1830 as Psophocarpus palmettorum (*Floræ Senegambiæ Tentamen*, p 222) from specimens which they had obtained climbing up palm stems near Cape Verde, West Africa

HISTORY OF PSOPHOCARPUS

Second mention

Third mention

Mention has been made of Wallich's distribution in 1828 on behalf of the East India Company of the large herbarium then formed Graham, the Professor of Botany at Glasgow, named Wallich's Leguminosæ and found both Psophocarpus tetragonolobus and Psophocarpus palustris among the specimens, but he did not at first recognise either, and named the one Dolichos ovatus and the other Dolichos suffultus Dolichos ovatus was however, almost immediately recognised to be Psophocarpus tetragonolobus

Wallich had both species from India

Graham did not recognise them

The first important work after this date is Roxburgh's *Flora Indica*, in which (iii 1832 p 305) he contents himself by saying ' Psophocarpus tetragonolobus is reared in gardens for the table, where indigenous I cannot say we have an herbaceous variety from Pegu with esculent roots It is astonishing that he does not give any vernacular name for the plant as though he had not known one In 1834 Arnott and Wight's *Prodromus Floræ Peninsulæ Indiæ Orientalis* was published They describe the plant which was evidently familiar (to Wight at least) from gardens at Madras, but without giving any other information In Graham's catalogue of the plants of Bombay published after his death at Khandala in 1839 Psophocarpus tetragonolobus is said to be cultivated in gardens and used like French beans ' in the Bombay Presidency— a native of Mauritius It is impossible to find out if Graham had any evidence before him when he said that the plant had come from Mauritius He gives no vernacular name

Indian references 1832—1839

In 1837 Blanco (*Flora de Filipinas* p 576) wrote that the plant is grown round Manilla and eaten

In the Philippines 1837

The first Indian vernacular name recorded is Charakoni Sem '— the familiar Bengali name —it was recorded in 1845 in Voigt's *Catalogue of the Plants cultivated at Serampore and Shibpur* Voigt runs wide of the mark when he suggests South America as its original home

In 1842 Hasskarl studied these beans in Java His work (*Flora*, xxv, *Beiblatter*, p 75) is a new landmark He found in Java that there were present both P tetragonolobus and P. palustris, and that the latter had two varieties But Psophocarpus palustris was not recognised by him as a

Hasskarl's account of the forms found in Java.

HISTORY OF PSOPHOCARPUS

Forms found in Java

described plant and consequently got the new name of Psophocarpus longepedunculatus It, he records, was called by the natives "Djaat monjet" (monkey djaat); while the two varieties of P. tetragonolobus were called respectively "Djaat' and "Djaat Putoi (Parkia like Djaat, because its pods were thought to be like those of the Parkia tree) Djaat is the long podded Psophocarpus tetragonolobus: Djaat Pütoi is narrow winged hence Hasskarl s name of *var* micropterus He brought all into cultivation in the Buitenzorg gardens (*vide* his *Tweede Catalogus der in slands Plantentuin te Buitenzorg gekweekte gewassen*, Batavia 1844, p 281)

Hasskarl wrote of the variability in colour of the seeds in his *Plantæ Javanicæ Rarories*, 1848, p 388

Miquel s account in 1855 (*Flora van Nederlandsch Indie*, i, p 181) is only a putting together of Rumpf s and Hasskarl s accounts

The name Djaat Putoi appears in Teijsmann and Binnendijk's Catalogue of the plants grown at Buitenzorg (*Catalogus plantarum quae in Horto Botanico Bogoriensi coluntur* Batavia, 1866, p 263) as Djaāt peteui, and of both Djaat and djaat peteui we have three races named which differ in the colour of the seeds

Djaat poetie—white seeds
Djaat ietam—black seeds
Djaat koenieng—yellow seeds
Djaat peteui poetie—white seeds
Djaat peteui ietan—black seeds
Djaat peteui koenieng—yellow seeds

Further confusion in names of P. palustris.

That most unfortunate plant Psophocarpus palustris, already with four names, obtained a fifth in 1858—P Mabala—from the African traveller Welwitsch (*Apontamentos sobre a Flora de Angola*, p 589) and later it seems again to have obtained another in Psophocarpus comorensis (Pierre in *Bulletin de la Société Linnéenne de Paris*, i, 1883 p 380, and in Grandidier, *Histoire physique, naturelle et politique de Madagascar*, ii, 1886, plate 34). We can now dismiss it with a few further remarks It has been found to be cultivated very widely in Tropical Africa Welwitsch found it generally cultivated in Angola at a little distance from the coast, its seeds eaten fried in oil under the name of "Mabala' (*Hiern, Catalogue of the African Plants collected by F Welwitsch*, i, 1896, p 26). Speke and Grant found it in Mozambique, Sir John Kirk found it on the Zambesi, others have found it in Calabar, at Nupe, and on the Congo (*vide* Baker in *Oliver s Flora of Trop Africa*, ii, 1871, p 208) Baron says (*Journ Linn Soc Bot* xxv, 1889, p 261) that it is common in both East and West Madagascar Bentham in *Martius, Flora Brasiliensis*, xv, pt i, 1859-62, p. 197, plate 52) shows that the plant has been taken to South America where it has long been established near the port of Bahia. Ito

Final remarks regarding P palustris

(*Tentamen Floræ Lutchuensis*) says that it is cultivated in the Luchu Islands

DISTRIBUTION OF P TETRAGONOLOBUS.

Possibly it is a native of Madagascar carried thence westwards through Africa and to South America and eastwards to Malaya, but the evidence is slender as far as it goes at present, and the less said the better

We have seen that it was once tried in Calcutta, but did not persist

Psophocarpus tetragonolobus, the plant that we are more nearly concerned with, is not to be found on the continent of Africa We have seen that before 1850 it had been noted to be in Réunion, India with Burma, Java and the neighbouring islands of Bali and Banda also in the Philippines and Amboyna Since 1850 it has been shown to occur in Mauritius, towards the western end of its distribution (Baker, *Flora of the Mauritius*, 1877, p 79), and in New Guinea at the eastern (K Schumann *Flora von Kaiser Wilhelms Land*, p 99, Schumann und Lauterbach, *Flora Deutsch Schützgebeit*, 1901, p 372, Warburg, *Pflanzenkleid und Nutzpflanzen Neu Guineas*, 1899 p 65) Safford records it from Guam 1 200 miles east of the Philippines, and peopled by a stock of Philippine origin (Useful plants of Guam in *Contributions from the United States National Herbarium*, ix, 1905, p 281)

Usteri (*Beobachtungen über tropische Märkte*, 1905, p 419) says that the bean is found in the markets of Java

In 1862 Sir George Birdwood (*Catalogue of the Economic Products of Bombay*, p 123) mentioned the plant as a Bombay product, fixing wrongly its home as Sicily upon an incorrect identification He gives the Bombay names as Chandaree, and Charputtee, and the Cinghalese name as Dara Dambala Lisboa in volume xxv of the Bombay Gazetteer, names the plant as Chowdari or Chevaux de frize of the French, describes it, and says loosely that "it is cultivated through Bombay and India"

WHERE GROWN IN INDIA

United Provinces

As **Psophocarpus tetragonolobus** likes a considerable quantity of moisture it is most abundant in the damper parts of India From the Panjáb it is almost absent, if not quite so. In the United Provinces it can only be got to ripen seed with some difficulty The late Mr William Gollan informed me that at Saharanpur it would make good growth during the rains, but would hardly bear more than a pod or two, and that it was lost to his garden some 15 years ago by not seeding

Deccan plateau

In the Central Provinces and Berar it is a little more at home, and can be found, but very rarely, in the village gardens. Sir George Watt collected it at Anjangaon in Berar in December 1894 and noted that it was only grown in a few villages A little later Mr F. G Sly, Commissioner of Settlements, Central Provinces who had it cultivated in the Government Garden, Nagpur, distributed it to the villages near

PSOPHOCARPUS WHERE GROWN IN INDIA

Nagpur, and in 1903 its cultivation had extended beyond the district of Nagpur In other parts of the Deccan plateau it is grown freely, as at Poona where large quantities come into the market and where with irrigation it is made to produce pods in the height of the hot weather (*vide* Woodrow, *Gardening in India*, ed. 3, 1899, p 267) In Mysore according to information kindly supplied by Mr J Cameron, it is largely cultivated

Bombay

Under the Western Ghats the plant is abundant. Mr R P. Mehta, formerly Deputy Director of Agriculture, Poona, informed me that it is not uncommon in Gujarat It is common in the Bombay market being grown near Bombay It is also common around Ratnagiri, and common near Goa

Bengal

On the Eastern side of India, it occurs not very frequently in Bengal, but commonly enough near Calcutta to be a well known vegetable The seeds are regularly sold by some of the native seeds men of the city and every now and then pods are offered for sale in the New Market. If grown at all in the valleys of Assam, the fact is *unknown to me It is grown at Chittagong (see Prain, Bengal Plants,* 1903, p 391) I have not seen it under the Eastern Ghats, nor obtained any information regarding it from districts north of Madras About Madras it is cultivated.

Madras

Burma

On the east coast of the Bay of Bengal it is to be found throughout Arakan It is cultivated almost everywhere in Burma and very widely in the Shán States which supply the seed to Central Burma Only in Burma it is a field crop elsewhere it is always a garden crop

The districts of Burma* in which the plant is most largely cultivated are —Kyauksè, Mandalay, Meiktila Yamèthin, Prome and Henzada There is a very little of it in the Mōng mit Shán State which is administered as a division of the Ruby Mines District and a little in the Upper Chindwin Division and a little in Katha In Hanthawaddy there is a little In Tharrawaddy it is almost absent Chinamen cultivate it on a small scale close to Rangoon It is cultivated in tiny garden patches in Bassein In Pegu it is found in *gardens only In Thatôn, it is more extensively grown by Karens on* the banks of the Salween

It is found in every village of the Hsipaw State (Northern Shán States) and on a fairly considerable scale in Hsumhsai Sub State In north and south Hsenwi it is fairly plentiful It is grown in the large Kengtung State

The sources of the seed supply in the Shán States are chiefly the villages of Kyauk Khwet and Kywet na [illegible] the bor[illegible] the

* The credit of getting together almost a[illegible] [illegible] belongs to Mr A Gaitskell I C.S, formerly [illegible] Land Agriculture Burma

Ye-Yaman tract of Kraukeh and Nge nin, also Maymyo which is in the Mandalay d strict tho gh on the Shan plateau Wetwun just east of Maymyo and Htilha ng in the Maw State (Myelat d str ct Southern Shán States)

PSOPHOCARPUS TETRAGONOLOBUS ITS NAMES.

Many of the names applied to Psophocarpus have an obvious mean ng I give them below as far as it is in my power —

In Maurit us and Réunion Po s Carré or Square pea

In India.

Among the Engl sh Goa bean

Among the Portuguese at Goa Fava de Cavallo or Horse Bean

Bombay Chandari (four winged)

Charputtee (four leaves)

Gherda (meaning bean at times meaning Dolichos Lablab only)

Bengal Chara koni sem (four cornered bean)

Lakar sem (stick bean)

Madras Morisa avarai (Maur t us Bean) *

Ceylon Dara dambala (four winged bean)

Burma Pe saung ya (bean l ke Averrhoa Carambola)

Pe myit (bean root) is the root

Karen hills Kaw Bemra (Burmese bean)

Shan h lls Hto pong (i e the Pong bean pong may mean happy) the root be ng Ho-l to pong

In the Strai s Settlements Kachang Botol or Kachang Botor (kachang means a bean but Botol or Botor is not sati factorily expla ned The theory that Ridley quotes in Journ Royal As atic Soc Straits Branch xxx 1897 p 114 that it comes from bot le is untenab e Rumpf s speculat on that it comes from the Arab c Batr seems far fetched)

In Java Botor kachang and Dja t

In Bali Caloncan

In Banka Cul bet

In Amboyna Botor

In the Ph l pp nes and Guam Sequ d llas Camaluson Calamismis Pallam or Pallang

No Indian names are old

The evidence of language is aga nst the bean be ng native any where with n the Indian Empire For none of the names g ven to t except Hto pong (Shán) have any impress of age they are all

* Achard in his 1500 Plantes d'Inde 1905 p 366 says that the Pondicherry name is Mou oukouavarecody which Mr C A Barber assures me must be due to some m sconcept on The terminat on cody means climber The test is Mor su ava a m sunderstood or else Murukku ava a mean ng cr sped bean.

ORIGIN OF PSOPHOCARPUS TETRAGONOLOBUS

uncorrupted expressions of the modern language in which they are used That it should be found wild in Burma proves nothing; for when wild it is certainly an escape from cultivation

If it be agreed that the plant is not Indian, then how did it reach India? Possibly by two ways (1) through Goa from Mauritius or more likely from Rodriguez, the island near Mauritius of which the Portuguese made much use, and (2) almost certainly from the Malay Islands by the Malay Peninsula just as Manioc did (see *the Agricultural Ledger* No 10 of 1904 p 124) Economic products establish themselves in new countries more easily than their names: the Goa bean lost its Malayan names on reaching Burma and became the pea like a *Carambola* and the pea with a tuberous root, names which, however, it took with it to Arakan, where the long cultivated plants do not generally pass by common Burmese names The Karens call it simply Burmese bean Only the Sháns apply to it a name *hard to explain*

Certainly not Indian

Now the Sháns say that it came from Burma and the Burmese sometimes say that it came from the Sháns; but it is perfectly certain that neither the one nor the other know whence it came to their country Possibly its field cultivation is more recent than its introduction into the country

One may freely speculate as to whether Psophocarpus reached Mauritius or Rodriguez from Malaya, or Malaya from Mauritius or Rodriguez There is only one point known to me that is useful for evidence, and that point is in the very probable African or Mascarene origin of Psophocarpus palustris For if Psophocarpus palustris took its origin in Africa or the Mascarene islands or Madagascar, then probably the very similar P. tetragonolobus had an origin in the same part of the world

Can it be Mascarene?

DESCRIPTION OF PLANT

Psophocarpus tetragonolobus is an annual, of 8—9 months duration, after fruiting it dies The tuberous root swells up very early; and when fruits are ripe it is already stringy and insipid

The common plant in India has yellow-brown seeds In Burma together with yellow brown seeded plants, are white seeded plants White seeded plants extend to Arakan but do not reach Bengal: I have also obtained white seeded plants from Hsipaw in the Shán States Very dark brown seeds have been seen from Nagpur.

The Burmese distinguish two races, long podded and short podded There is no great difference between them The long podded in Burma is generally 6—8 inches long (Rumpf says that in Amboyna it may be a foot long), and the short podded in 4—5 inches long Short podded specimens have been seen by me from Prome, in the Pegu bazaar and near the Sittang river at Minywa

Cultivation

CULTIVATION

In the Shán States the seeds are planted in the beginning of June or when the rains begin, three inches deep in village gardens Rich

wet soil is chosen, or if the soil is not very rich plentiful watering is resorted to. In some of the Southern Shán States such as Kentung, one finds two or three plants in the corner of a garden here and there. But in parts of the Northern Shán States the plants are much more plentifully sown There they are to be seen in Taung yas or forest clearings, generally where bonfires have been made round the dying trunk of a tree too large to have been cut out, *i e*, where the burning of rubbish, branch wood, etc, has manured the soil If the plant be sown in a garden, ridging is often resorted to

CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS

Shan States

The seedling is left to take care of itself as soon as established, having been provided with something up which to climb It grows to 10—12 feet high Sometimes the Shâns dig the root up and eat it, but more generally they leave it to produce beans which are gathered young except those intended to set seed The crop is gathered in December and January The tuber is said to be much larger than is produced in Burma

The cultivator saves his own seed, but in the Hsum hsai Sub State, which is west of Hsipaw, the Shâns produce seed for sale to Burma, and so also is done in the near parts of the Maymyo sub division of the Mandalay district This seed produced is carried down to the plains and grown in the Central parts of Burma, and it sells in Kyauksè at R7-8 and sometimes R10 (10*s* and 13*s* 4*d*) per basket (1½ bushel) or double the price of local seed Through the Director of Land Records and Agriculture, Burma I have received the following interesting information got together by Mg Shwe Zan Aung, Superintendent of Land Records, Kyauksè —

Kyaukse

Causes of variation

"While much of the quality depends upon the care bestowed on the selection of seeds the difference between plants grown from Shán seed and locally saved seed may still further be ascribed to the fact that in spite of the more abundant rainfall in the Shán States the hilly country is not exactly waterlogged as the plains are, for it will be noticed later on that the excess of moisture in the ground materially affects the yield

"This is the reason why the fields slightly higher than the rest in a holding have been selected with better results than the low grounds

Soils

"Goa beans thrive very well on clayey soils or non myenu, but the tubers are too big to be prized by the people Sandy loam or sanemye is said to be best suited for the cultivation The crop has also been known to grow on clayey loam or phutchai mye.

Ploughing

"About the months of May or June (*i e* Kason or Nayon) water is let onto the selected fields from the irrigation channels and the land is lengthwise, crosswise and diagonally ploughed

Harrowing and hoeing.

"In July or August (Waso or Wagaung) as the case may be, the land is harrowed and hoed into furrows between which ridges or "baungs" 2 feet broad and 1 foot high are prepared with a spade, 1½ feet apart in order not only to admit air and water freely and to drain off water effectively

CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS

"Then the seeds are buried in small holes, about 3 by 6 inches apart, specially prepared for the purpose on the ridges

Sowing

"Two baskets of seeds go to an acre If the local seeds popularly styled 'Pegale' (little bean) in contradistinction to 'Pegyi' (large bean) the parent seed be used, the operations are generally a month later

Irrigation

"Immediately after sowing the field is flooded from the Irrigation channels, but the water is withdrawn at once

"The land is again subjected to alternate flood and drainage until the harvest It is done at least three times every two months or according to the amount of the rain fall

'Great care should be taken not to allow the water to remain long on the fields except when the plants have flowered or fruited, for as stated elsewhere, the excess of moisture tends to reduce the number of tubers

Weeding

"Weeds are periodically removed—say twice or thrice during the season as the case requires—chiefly by women who are paid at 2 annas each with free meals provided by the cultivator for the day The superfluous growth among the creepers has to be plucked out by hand Thus the work of weeding is a tedious process and is expensive Stakes are not used, the plants are left to lie along the ground From January to March, *i e*, (Pyatho to Tabaung) when the land is fairly dry the tubers are dug up by men and gathered by women Each labourer is paid either by the contract, or by daily wages when the out-turn is bad The contract is 1 anna per 10 viss of tubers collected The daily rate is R0-6 0 (*6d*) for each man and R0-4 0 (*4d*) for each woman

' In either case in addition to these rates a bag or a load of tubers is appropriated by each labourer as his lawful wages The digging operation serves a double purpose, 1st, for the harvest, 2ndly, as a preliminary loosening of the ground for the following crop, *viz*, sugarcane in the Singaing township and early sesamum elsewhere

Manuring

' Farm yard manure is known to have been used with advantage Cart loads of cow dung are scattered in small heaps and distributed by water at the time of ploughing

Diseases of the crop

"No insect pests are said to have injured the crop But if not *preceded by a crop especially paddy, i e*, if grown on fallow land or virgin soil, the tubers become covered with excrescences Although not exactly a disease, it is a failure from the popular point of view

Average cost.

"The average cost per acre of the cultivation may be tabulated as follows —

	R	*a*	*p*	
Ploughing	2	0	0	(*2s 8d*)
Harrowing	1	0	0	(*1s 4d*)
Preparing ridges	2	8	0	(*3s 4d*)
Weeding (twice)	8	12	0	(*11s 8d*)
Cost of seed	14	0	0	(*18s 8d*)
Sowing	3	0	0	(*4s*)
Harvesting	9	6	0	(*12s 6d*)
TOTAL	40	10	0	

add to this R8 (10s. 8d) or R7 (9s 4d), the Government Revenue, including the water rate as the land is state or non-state The above is a consolidated revenue of which R1-4 (1s 8d) in the case of state lands and R0-14 (1s 2d) in that of non state lands have been fixed as land rents The total outlay therefore amounts to R48-10-0 or R47 10 (64s 10d or 63s 6d).

CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS

"The average yield per acre is 1,500 viss (48 cwt 99 lbs) of tubers valued at R67-8 (90s) at the wholesale price of R45 (60s) per 1,000 viss (32 cwt. 66 lb) and the net profit amounts to R19-4 or R18-4 (25s 8d or 24s 4d) per acre

Average outturn and value

"As with other crops, so with this there are 'middle men' popularly called "Ywe' who sell the tubers to 'Letka' at the retail price of R65 (86s 8d) per 1,000 viss (32 cwt. 66 lb)

"The margin left to the *bona fide* cultivators after trouble and expenses would by itself not be encouraging, but the cultivators in Singaing township generally grow a bumper crop of sugar-cane in the year after Goa beans It is said that the cane crop, if preceded by Goa beans, yields half as much again as usual

Its relation to sugar-cane

"If any plants are left to seed the young pods may be picked and used as a vegetable No use is made of the ripe seed unless it be that now and then in the Ye Yaman tract, some mischievous person saves it and sends it up to the Shán hills for thé purpose of adulterating good Shán seed, or it is locally sown for two generations yielding a less and less valuable crop each time

Pods and Seed

"As far as can be ascertained there is no record of its introduction into the province '

Some time after the receipt of the above report Mr H B Powell, who had succeeded Mg Shwe Zan Aung as Superintendent of Land Records, Kyauksè, supplied information that the area under the crop had undergone a slight decrease owing to want of water for irrigation, several irrigation works being under repair—

Acreage

1898	975 acres
1899	737 „
1900 .	807 „

As he anticipated the acreage rose again and was 2122 in 1901-02, though less again since

Mr T C Wilson, Settlement Commissioner and Director of Land Records and Agriculture, Burma has kindly supplied to me the figures which may be found on p 63

The districts that adjoin Kyauksè are Mandalay Sagaing, Myingyan and Meiktila

In Mandalay the cultivation is apparently of more recent origin than in Kyauksè The method and the cost is the same as in Kyauksè The market for local produce as well as very much produced in Kyauksè is in Mandalay, where 100 viss (365 lbs) sell for R10 (13s 4d) in December and less sums down to R5 (6s 8d) in

Mandalay

CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS

January, the immature pods sell in Mandalay at about R5 (6*s* 8*d*) per 100 viss (365 lbs) Seed in Mandalay sells at R5 (6*s* 8*d*) per basket, and a basket of seed gives at the most 700 viss (22 cwt 91 lb) of roots or 1 400 viss (45 cwt 70 lb) per acre Pe myit is not grown in the district of Sagaing and Myingyan

Meiktila

In Meiktila there is not much cultivated what little there is is in the Nyaungyan circle The outturn is about 600 viss (19 cwt 62 lb) per acre

Yamethin

South of Meiktila is the district of Yamethin where a small acreage has been grown on the border of a large swamp in the vicinity of Pyinmana since 1878

The seed is sown 2 inches apart on ridges 8—10 inches high and 12 inches apart, at the end of June or beginning of July, and the tubers are in the market in January and February

Cost

The cost of cultivation for an acre is as follows —

	R	a	p	
Half basket of seed at R10 (13*s* 4*d*) per basket	5	0	0	(6*s* 8*d*)
Making ridges . .	9	0	0	(12*s*)
Weeding .	1	4	0	(1*s* 8*d*)
Digging up of tubers . . .	16	0	0	(21*s* 4*d*)
Yearly interest on a yoke of plough cattle . . .	1	12	0	(2*s* 4*d*)
TOTAL	33	0	0	(44*s*)

Yield

The yield per acre varies from 800 to 1,200 viss (26 cwt 8 lb to 39 cwt 12 lb) of tubers

It is cultivated chiefly for its tubers Pods or beans are not allowed to go to seed but are plucked when tender and sold as a vegetable the value of tender beans per acre is about R7 (9*s* 4*d*)

Not being cultivated for its seed, it is not trained on sticks Plants grow to a height of one foot and are allowed to creep or overhang the raised ridges on which they are grown

The price of the tubers is R6 (8*s*) per 100 viss (365 lb)

The area under Goa bean cultivation in the district is insignificant

Prome and neighbouring districts.

In the districts of Prome Henzada Hanthawaddy and Tharrawaddy we have rather a different cultivation, for here the land periodically flooded by the river Irrawaddy is used and we have also a little garden cultivation on soils not so sandy as the river soils The tuber grows larger in the sandy than in the clay soils but has not such a good flavour The seed is sown on manured ground and is given bamboos to climb up The crop is said to be dug in Henzada in November and December Cultivation is estimated to cost R40 (53*s* 4*d*) per acre and the yield to be 1,200 viss (39 cwt 12 lb) The tubers sell at about R12 8 (16*s* 8*d*) per 100 viss (365 lb) We find cultivation very similar to this in the Thatôn

Thaton.

district, where the banks of the Salween are used, and traders dispose of the produce in Moulmein The seed is there sown in small furrows 8 inches wide and 2 inches deep It seems that in Thatôn certain islands in the Salween are allowed to produce seed for the local crop.

CULTIVATION OF PSOPHOCARPUS TETRAGONOLOBUS

Northern Burma

In the north of Burma for Pe-myit we find garden cultivation and a little Taung ya cultivation as in the Shan hills, also a very little about Katha on islands in the river Irrawaddy

In the Upper Chindwin district it is, for instance, always given sticks for support

Arakan

In Akyab it is grown a little on Taung yas or hill clearings The same is apparently the case east of Chittagong

Extent of cultivation in Burma in acres

	Mandalay	Meiktila	Kyauksè	Yamethin	Thatôn
1897-98	—	—	975	20	42
1898 99	26	—	737	20	130
1899-00	44	—	607	20	170
1900-01	60	—	1 243	0	133
1901-02	150	—	2 122	20	130
1902 03	38	97	998	38	140
1903-04	23	33	720	9	253
1904 05	75	42	803	19	297
1905-06	71	14	819	21	291

Bengal

About Calcutta it is only to be found in gardens I have grown it myself for several years sowing the seed early in the rains, and getting a crop of young beans in November and December

Poona

Over the rest of India it is grown in the same way, but Woodrow recommends sowing it on irrigated ground about Poona at the end of the rains in order to get a crop of young beans in the height of the hot weather when vegetables are scarce (Woodrow *Gardening in India* 3rd Edn, 1899 p 267)

USES

The root is eaten by Burmese between meal times as a delicacy, and there is an established standard size for it which sells according to season at 1 anna to ½ anna (*1d* to *½d*)

The trade in the roots is a large one and they are sent in considerable quantities more than 200 miles by rail or river Kyauksè supplies Bhamo on the north with large quantities through Mandalay and Pegu (almost certainly also Rangoon) on the south

The root is eaten without cooking and is slightly sweet firm like an apple and by no means unpleasant

The unripe beans are mostly eaten locally and are not a large article of trade They are inferior to French beans in flavour, but stand near them I have myself eaten them many times

PSOPHOCARPUS TETRAGONOLOBUS

Dried roots from Kyauksé were found to have the following constituents (Hooper in *Report of the Indian Museum, Industrial Sections* for 1901 02, page 30) —

Analysis of root

Water	9 05
Oil	98
Albuminoids	21 62
Carbohydrates (Starch and some sugar)	56 07
Fibre	5 38
Ash	3 90
TOTAL	100 00

The seed, not eaten in India, has the following composition (Hooper in *Report of the Indian Museum, Industrial Section* for 1902-03, page 26) —

Analysis of seed

Water	9 50
Oil	15 46
Albuminoids	37 43
Carbohydrates	28 38
Fibre	4 98
Ash	4 25
TOTAL	100 00
Containing Phosphoric acid	1 35
„ Nitrogen „	5 99

They are however eaten in Java, roasted in an iron pot until the shell cracks off

In Kentung the root is said to be used as material for making a poultice for the head and neck in cases of vertigo

PESTS.

Two fungus pests have been found on it in Java, the one Woronimella Psophocarpi described by Raciborski in Zeitschrift für Krankheiten, 1898, p 98, the other an Uromyces described by Sydow in 1903

G I C P. O—No 1157 R. E P —30 11-06.—2,500—P M. M

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Reporter on Economic Products to the Government of India, Calcutta

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions. Contributions or corrections and additions will therefore be most welcome

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series. Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series, those on Forestry in the Forest Series. Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series.

(Vegetable Product Series, No. 97.)

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1906—No. 5.

COCHLOSPERMUM GOSSYPIUM.

(SEEDS & OIL.)

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. II., C. 1512-1519.*

A short Account of the seeds and oil of Cochlospermum Gossypium, *by* BABU SURENDRA NATH DEY, B.A., *Assistant in the Chemical Laboratory of the Indian Museum, Industrial Section.*



CALCUTTA
OFFICE OF THE SUPERINTENDENT, GOVERNMENT PRINTING, INDIA.
1906.

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THE
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(Vegetable Product Series, No. 97.)

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COCHLOSPERMUM GOSSYPIUM.

There are several trees in India which have again and again been suggested as sources of silk-cotton or 'kapok' cotton, now exported from Java in considerable quantities chiefly for upholstery purposes In Java the tree yielding this material is Eriodendron anfractuosum,—a tree which is planted more for ornament than for use in Burma and on the West coast of India, but in India has never been exploited as a source of 'kapok cotton On the other hand, considerable effort has at various times been employed to introduce two other similar kapoks' to the trade one obtained from Bombax malabaricum, a common tree throughout the country and the other from Cochlospermum Gossypium, which occurs commonly in the drier parts of North India This tree, according to Gamble, is characteristic of the hottest, driest, stoniest slopes, and it would obviously be of great value if its productions in the shape of silk cotton or of seeds or of both could be turned to account The Reporter on Economic Products to the Government of India has lately issued, as *Commercial Circular* No 2 of 1905, a report made by Professor Wyndham R Dunstan on the relative value of the flos or silk cotton produced by this tree in the present report it is proposed merely to give an account of the seeds and the oil produced from them

Yields Kapok

Use of the seeds as food.

Up to the present, even in the districts where the tree occurs, little use has been made of the seeds They have been used for food in Celebes (*Pharmacographia Indica, p 151*) where they are roasted before being eaten. In India, however, no record seems to

COCHLOSPERMUM GOSSYPIUM.

exist of their ever having been so employed There seems, however, no reason why in cases of necessity they should not be used in this way.

The seeds themselves are kidney shaped or cochleate with a hard shell, about $\frac{1}{4}$ to $\frac{1}{12}$ inch long about 400 going to one ounce They have a pleasant sweetish somewhat almond-like flavour when tasted, followed by a slight bitterness which can hardly be called objectionable On analysis they gave the following figures :—

Analysis of seeds.

	Per cent.
Moisture	9 25
Oil	14 25
* Albuminoids	20 94
Carbohydrates	35 78
Crude Fibre	14 63
† Ash	5 15
	100 00

	Per cent
* Containing Nitrogen	3 35
† Containing Phosphoric Acid	0 96

The seeds contained no alkaloids, and were free from tannin Very small traces of starch were found A non reducing sugar of the saccharose type was present in some quantity, and a considerable quantity of dextrins No evil effect followed the eating of a fair number of the seeds As a further test, a quantity of the pressed oil cake was given to a calf and a goat Neither of them ate it with relish, but both did so after a short time This was followed by no evil result in either case

It may be taken, therefore that the seeds of Cochlospermum Gossypium form a fairly nutritious food, and in case of necessity would be quite adapted for this purpose both for animal and man

Analysis of oil cake

The analysis of the cake is given below —

	Per cent
Moisture	9 90
* Albuminoids	21 50
Oil	8 10
Carbohydrates	39 88
Fibre	15 17
† Ash	5 45
	100 00

	Per cent.
* Containing Nitrogen	3 44
† Containing Phosphoric Acid	0 98

It will thus be seen that the oil-cake is fairly rich in nitrogen and phosphoric acid and there seems to be no reason why it should not be used either as a manure or cattle food

Up to the present very little notice seems to have been taken of the oil yielded by the seeds regarding its nature and use "The

Revd A Campbell of Chota Nagpur describes a bright red oil which by hot expression he extracted in abundance from the seeds He adds although this property of the seeds is well known to the Santals they never extract the oil Cook in his *Oils and Oil-seeds* alludes to this circumstance, but remarks that beyond the fact of the seeds affording an oil, nothing further is known' (*Watt Dict Econ Prod C 1516*) Mr J S Gamble is content to remark in his *Manual of Indian Timbers* (edition 1902) that the seeds give an oil which is little used ' He gives no further information nor is there any information available as to the oil ever being used as an edible oil

COCHLOSPERMUM GOSSYPIUM

Nature of the oil

The oil, which was present in our samples of seed to the extent of 14 to 15 per cent was expressed with a screw press and filtered before examination The filtered oil was rather thick, of brown colour, the colour getting lighter after several days exposure to the diffused day light ultimately assuming a yellow colour, while the oil got quite bleached in 24 hours when exposed in thin layers But it may be mentioned here that the oil when extracted with ether was almost colourless, having a slight yellowish tinge It had a peculiar smell and taste of its own was a liquid at the ordinary temperature solidifying at 1° C and having 922 for its specific gravity at 15° C On analysis it gave the following results —

Acid value	Saponification value.	Hehner value (Insoluble fatty acids)	Iodine value	Reichert Meissl value
14 24 Mgrms KHO	186 29 Mgrms KHO	95 19%	95 97%	19 c c $\frac{N}{10}$ KHO

Maumené test or the rise of temperature of 50 grammes of the oil with 10 c c of pure concentrated sulphuric acid was observed to be 54° 5 C On the addition of sulphuric acid the oil turned blue black first and black afterwards The melting point of the fatty acids was 35° 5 C

Not a quick drying oil.

The iodine value and the Maumené test suggested that the oil might occupy an intermediate position between a semi drying oil and a non drying oil, since a drying oil is characterised by its greater absorption of oxygen and iodine and by its higher rise of temperature on mixing with strong sulphuric acid than a non drying oil

To test its drying property a clean glass plate was coated with it on one part and with fresh raw linseed oil on another part and was exposed at the temperature of the Laboratory At the expiration of 98 hours the linseed oil got quite dry while the other only became sticky Further zinc pastes of the two oils were compared and similarly those

COCHLOSPERMUM GOSSYPIUM. OIL

of lead pastes Five grammes of oxide of zinc and 2 c c of the oil composed the zinc paste and 5 grammes of white lead and 1 c c of the oi the lead paste A glass plate was coated with the two zinc pastes and similarly another with the two lead pastes They were then exposed in the Laboratory In 22 hours the zinc paste of the linseed oil dried completely and that of the other oil became very sticky In 72 hours the latter was tacky and got very tacky in 96 hours, *i e*, on the 5th day and remained so till in 146 hours, *i e.*, on the 7th day it got almost dry and continued to remain in this condition even for a month. The white lead paste of the linseed oil dried completely in 26 hours, *i e.* on the 2nd day, whereas the lead paste of the other oil became only tacky on the 8th day and never got dry even after a month.

Its power of absorbing oxygen was also compared with that of fresh raw linseed oil by heating equal quantities of each for 6 hours daily up to the temperature of the steam oven One hundred parts of the linseed oil thickened in the first 24 hours and increased to 102 7, the next day a skin began to form over its surface, the weight was 104 52 and remained constant until the 5th day when the oil had been converted into a firm jelly While, on the other hand, 100 parts of C Gossypium oil did not show any increase in weight even after a week when it simply thickened

From these above facts it was proved that the C. Gossypium oil was not a drying oil possessing drying qualities to a very limited extent, as was proved by the experiment of zinc oxide paste

Samples of this oil were shown at the late Colonial and Indian Exhibition and these are now deposited in the Kew Museum According to Sir George Watt, this oil can be produced cheap and in large quantities, and it may be hoped that at some future time it may be utilised if not for any other technical purpose than for the manufacture of soaps

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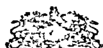
AGRICULTURAL LEDGER.

1906—No. 6.

BEADS.

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. I., B. 372-387.*]

Materials used in making Bead Chains and Rosaries in India By E. F. VIEUX, *Assistant Curator, Indian Museum, Industrial Section*



CALCUTTA
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MATERIALS FOR BEADS

Bead chains are made in India from many materials and worn by almost all classes of people out of religious or superstitious motives

The following pages are an alphabetical catalogue of the materials used with reference to specimens exhibited in the Industrial Section of the Indian Museum, Calcutta

Abrus precatorius

Abrus precatorius—*Linn*—The Crab s eye or *rati* seeds—A climber met with all along the Himalayas and spreading through the plains of India to Ceylon and Siam The seeds are found in three different colours —

(1) Red seed with black eye
(2) Black seed with white eye
(3) White seed often dirty white

The first and commonest is alone used for bead chains As far back as 1592 mention was made by Prosper Alpinus of the use of these seeds as beads Its extensive use for necklaces and in rosaries suggested the latin name ' precatorius "

Adenanthera pavonina

Adenanthera pavonina—*Linn*—The red wood or *rakta kanchan*—A tree of very general distribution throughout India with bright scarlet or more rarely yellow brown seeds The scarlet seeds are made into bead chains worn about the neck

Adhatoda Vasica

Adhatoda Vasica—*Nees*—The *Baxas* of Bengal—A small bush often gregarious found very widely in India from the Sub-Himalaya tracts to Ceylon The Nagas use the stems of this shrub for divining and for foretelling omens A superstition prevails that the fruit of this tree if hung round the necks of children keeps them free from colds The wood is made into small beads

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BEADS

Ægle Marmelos

Ægle Marmelos.—*Corr*—The *Bael* or Bel fruit tree —This tree is found in cultivation all over India and wild in the Sub Himalayan forests from the Jhelam eastwards, in Central and South India and in Burma It is sacred amongst the Hindus and fre quently alluded to in ancient Sanskrit poems as an emblem of increase and fertility having sprung from the milk of Shri the goddess of abundance Its leaves are used in the worship of Siva and of Parvati The beads made from this are strung with the fibre of *Agave* and are worn by the Sudras to denote that they are not Muhamedans

Æschyno mene aspera.

Æschynomene aspera —*Linn*—The Sola —A small sub floating bush frequently found in marshes and growing mostly during the season of inundation in Bengal, Assam Burma and South India It is used for decorating idols during certain festivities

Allium sati vum

Allium sativum —*Linn*—The Garlic —Cultivated all over India In Poona it is stated that a necklet of the bulbs is worn by children suffering from whooping cough

Aquilaria Agallocha

Aquilaria Agallocha —*Roxb*—The Eagle wood —A large evergreen tree of Sylhet and Tenasserim extending through Manipur, Chittagong Arakan to Mergui and Sumatra The wood is largely used for rosary beads

Areca Catechu

Areca Catechu —*Linn*—The betel nut palm —A cultivated plant found throughout tropical India The nut is used in many religious ceremonies and in beads

Cæsalpinia Bonducella

Cæsalpinia Bonducella —*Fleming*—The fever nut —Found all over India especially in Bengal Burma and Southern India bearing seeds or nuts It is stated in Bombay that necklaces of the seeds strung upon red silk are worn by pregnant women as a charm to prevent abortion They are also hung upon trees to prevent their fruit falling off In Egypt the nuts are strung as necklaces and worn by women as amulets against sorcery

Canna indica

Canna indica —*Linn*—The Indian shot —This plant is common all over India and Ceylon, chiefly in gardens where it is grown for ornament It flowers all the year round, and has a black [illegible] ung as necklaces

Caryota urens.

[illegible] palm —A beautiful [illegible] eastern moist zones It is common in Bengal Burma and Orissa The seeds are used by Muhamedans as beads

Coix Lachry-ma Jobi

Coix Lachryma-Jobi —*Linn*—Job s tears —A tall erect grass met with on the plains of India and on the warm slopes of the hills from the Panjab to Burma The three varieties—*viz*, *typica monilifer* and *stenocarpa*—are very extensively used as rosaries The first variety is used by the Chins for their rosaries It may also be used in Hoshangabad and Bhandara by the Gonds and Kúrkús where boys are made to wear the grains in the form of necklaces The second variety is also worn by Burmans and more especially

those of North Arakan and the Kachin Hills It is the third variety *stenocarpa* which is the general ornament of a Kachin garment The nut is very much elongated, generally being nearly ¾ of an inch long The Chins wear it strung into necklaces

BEADS

Cocos nucifera

Cocos nucifera —*Linn* —The Cocoa nut palm —A palm cultivated throughout India and Burma. It is in some measure held sacred Beads made from the shell are said to be very common in Burma It is darkened by steeping in oil Hindu women wear necklaces of the dried kernel The cocoa-nut itself is largely employed as offerings to the gods by the Hindus, and cocoa nut day (the full moon in August) is celebrated throughout the country.

Corypha umbraculifera

Corypha umbraculifera —*Linn* —The fan palm of South India —A large cultivated tree in Bengal and Burma Flowers at the beginning of the hot season The fruit or nut is hard like ivory and is carved into beads that resemble the Rudraksha' seeds The beads are worn by Hindu devotees

Elæocarpus Ganitrus

Elæocarpus Ganitrus —*Roxb* —The utrasum bead tree or *Rudraksha* —This is a large tree found in Nepal, many of the sub divisions in Assam (*viz*, Lakhimpur, Mangaldai and Golaghat) and in the Concan ghats It is also very common in Singapur from where it is said the nuts are largely imported Some few years ago—in 1899—when it was reported that a trade in these nuts would be advantageous, it was ascertained from Assam that the sale price per maund (82⅔lb) of the nuts would be R10 (13*s* 4*d*) at Dibrugarh and R12 8 (16*s* 8*d*) at Calcutta, but no dealers in that province came forward to establish the trade In Bombay an experiment was tried by a local gentleman on the other uses to which the seeds could be put, and hat pins, coat buttons and the like were the results A further experiment was made by coating the ' Rudraksha" with copper and silver after removing the seed by burning and the effect was said to be very satisfactory

The followers of Siva make it a religious duty to wear a necklace of these seeds in order to obtain the heaven wherein Siva resides and sometimes also in the belief that it wards off pains It is believed by some that these seeds bear marks resembling the human face and others maintain that the *Rudraksha* necklace is the symbol of the ' Eyes of Mahadev'

The seeds are either of a deep straw colour or dark brown but if the latter and too dark they can be whitened by immersing them in a solution of chlorine for about 12 hours and then washing and drying The chlorine is generated from a mixture of nitric acid and chlorate of potash, two parts of strong nitric acid being diluted with four parts of water and one part of chlorate of potash added The nuts are then immersed in the liquid and the glass vessel is placed in a warm situation until they are sufficiently bleached The acid is then poured off and the nuts washed well with hot water and dried

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ERRATUM

5 (1906) Cochlospermum Gossypium—A Short Account of the Seeds and Oil page 67, line 4, for Cook read Cooke

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In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series, those on Forestry in the Forest Series Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series